PROJECT MANUAL
FINAL CHECK SET
30 June 2022

STOW TOWN HALL RESTORATION
375 Great Road
Stow, Massachusetts 01775

Awarding Authority:
Town of Stow
Select Board
380 Great Road
Stow MA 01775

Architect:
Mills Whitaker Architects LLC
PO Box 750089
Arlington MA
Tel: 617-876-7611

Surveyor:
Reed Land Surveying Inc.
109 Rhode Island Rd. #4A
Lakeville MA 02347
Tel: 508-923-1181

Civil Engineer:
PVI Site Design LLC
18 Glendale Road
Norwood MA 02062
Tel: 339-206-1030

Landscape Architect:
Warner Larson Landscape Architects Inc.
130 West Broadway
Boston MA 02127
Tel: 617-464-1440

Structural Engineer:
Structures North Consulting Engrs. Inc.
PO Box 8560
Salem MA 01971
Tel: 978-745-6817

Mechanical & Electrical:
BLW Engineers Inc.
311 Great Road / PO Box 1551
Littleton MA 01460
Tel: 978-486-4301

Lighting Consultant:
Available Light Inc.
31 State Street, 6th Floor
Boston MA 02109
Tel: 617-944-6800

Audiovisual & Acoustics:
Acentech Incorporated
33 Moulton Street
Cambridge MA 02138
Tel: 617-499-8000

Sustainable Design Consultant:
The Green Engineer
23 Bradford Street
Concord MA 01742
Tel: 978-369-8978

Environmental Consultant:
Universal Environmental Consultants Inc.
12 Brewster Road
Framingham MA 01702
Tel: 508-628-5486

Cost Estimating
CHA Consulting Inc.
1 Faneuil Hall South, Suite 4195
Boston MA 02109
Tel: 617-451-2717

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Stow Town Hall Restoration

375 Great Road

Stow, Massachusetts 01775

The Town of Stow, Massachusetts, requests bids for the "Stow Town Hall Restoration". The estimated cost is approximately $3.5 million (**Escalation beyond 2021 Required**).

Bid documents prepared by Mills Whitaker Architects LLC will be available as of 12:00 Noon on **DATE T.B.D.** online at www.atjplanroom.com, a service of the Andrew T. Johnson Co. (ATJ), 15 Tremont Place, Boston MA 02108 (617-742-1610). Visit "Public Jobs" in the online plan room where Drawings and Specifications will be available to view and download. To download you must register for a free account, which will place you on the Plan Holders list to receive addendums and the filed sub-bidder results when issued. Bidders requesting hard copies may do so by providing a Document Deposit in the amount of $150 in a certified or cashier's check made to the Town of Stow and provided to ATJ at the counter upon pickup. Bidders requesting documents to be shipped shall include a separate check, (company, certified, or money order) made out to Andrew T. Johnson Co. in the amount of $40.00 for UPS Ground.

Interested Bidders are welcome to attend a Pre-Bid Conference to review the existing site and building at 375 Great Road at 12:00 NOON on **DATE T.B.D.**.

Filed Sub-bids are required for the following categories of work: 04 Masonry, 09 Painting, 14 Elevators (LU/LA), 22 Plumbing, 23 HVAC and 26 Electrical Work. Filed Sub-bids are due no later than 12:00 NOON on **DATE T.B.D.**. Sub-bids will be opened publicly and the results will be distributed to all Plan Holders.

General Bidders must be certified by the Division of Capital Asset Management (DCAM) in the "General Building" category. General Bids are due no later than 12:00 NOON on **DATE T.B.D.**. General Bids will be opened publicly where noted below.

All bids must be submitted in accordance with the "Instructions to Bidders" in the Project Manual and be delivered to the Town of Stow, Town Administrator, Town Building, 380 Great Road, Stow MA 01775.

Bidding procedures are governed by M.G.L. Chapter 149. The Town of Stow is an affirmative action, equal opportunity Awarding Authority.

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SECTION 00 21 13 – INSTRUCTIONS TO BIDDERS

1. RECEIPT AND OPENING OF BIDS

The Town of Stow, Massachusetts, herein called the Owner, acting by and through its Select Board, will receive sealed Bids for the project known as the "Stow Town Hall Restoration" project.

Bids shall be submitted in accordance with "Section 00 11 13 – Advertisement for Bids" and shall be prepared on the form provided in "Section 00 41 13 – Bid Form / Stipulated Sum."

Any bid may be withdrawn prior to the scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified will not be considered. The bidder agrees that its bid shall be good and may not be withdrawn for a period of 30 days, Saturdays, Sundays, and legal holidays excluded, after the opening of bids.

2. LOCATION AND WORK TO BE DONE

The Work consists of repairs and alterations to the building for various accessibility, life safety, and building system improvements to meet current building codes and all work incidentals thereto, in accordance with the Specifications and Drawings attached hereto.

Additional drawings showing details in accordance with which the Work is to be done may be furnished by addendum from time to time during the bidding period by the Architect and shall then become a part of the Contract Documents.

The Contractor shall furnish all labor, services, materials, equipment, plant, machinery, apparatus, appliances, tools, supplies, and all other things necessary to do all work required for the completion of each item of the Work and as herein specified.

The Work to be done and paid for under any item shall not be limited to the exact extent mentioned or described but shall include all incidental work necessary or customarily done for the completion of that item.

3. PREPARATION OF BID

Each bid must be submitted on the prescribed form. All blank spaces for bid prices must filled in, in ink or typewritten, in both words and figures.

Each bid must be submitted in a sealed envelope bearing on the outside the name of the bidder, his address, and endorsed with the name of the project as specified in Receipt and Opening of Bids, above. If forwarded by mail, the sealed envelope containing the bid must be enclosed in another envelope addressed as specified in Receipt and Opening of Bids, above.

4. BID OPENING PROCEDURE

The following list of requirements shall apply to each filed bid. Bids not meeting all the requirements for timeliness and security will be rejected; bids not meeting signature and addenda requirements will be rejected prior to checking of bid amounts.

Bids shall be filed at the place and before the time specified in Receipt and Opening of Bids, above.

Properly executed bid security shall be placed in a sealed envelope and shall be attached to the outside of the envelope containing the bid.

Bid signatures will be checked.

All addenda will be sent certified mail, with return receipt requested, and/or facsimile or e-mail to all prospective bidders. All bidders shall include with their bids written acknowledgment of any and all addenda as provided in "Section 00 41 13 – Bid Form / Stipulated Sum."

The total dollar amount of each bid will be read, and the three apparent lowest bids will be selected for further consideration. These three apparent low bids will be read aloud for the benefit of the other bidders and the bid opening procedure will be closed. All those present at the bid opening may examine all bids after the bid opening and after the reading of the three apparent low bids.

5. MODIFICATION

Any bidder may modify his bid by written communication at any time prior to the scheduled closing time for receipt of bids. Any telegraphic communication must be received by the Owner prior to the closing time, and, provided further, the Owner must be satisfied that a written confirmation of the telegraphic modification over the signature of the bidder was mailed prior to the closing time. If written confirmation is not received within two days from the closing time, no consideration will be given to a telegraphic communication.

The communication shall not reveal the bid price but shall provide the addition or subtraction or other modification so that the final prices or terms will not be known by the Owner until the sealed bid is opened.

6. ABILITY AND EXPERIENCE OF BIDDER

No award will be made to any bidder who cannot satisfy the Owner that he has sufficient ability and experience in this class of work and sufficient capital and plant to enable him to prosecute and complete the work successfully within the time named. The Owner's decision or judgment on these matters will be final, conclusive, and binding.

The Owner may make such investigations as it deems necessary, and the bidder shall furnish to the Owner, under oath if so required, all such information and data for this purpose as the Owner may request.

7. CONDITIONS OF WORK

Each bidder must familiarize himself fully with the conditions relating to the construction of the project and the employment of labor thereon. Failure to do so will not relieve a successful bidder of his obligation to furnish all material and labor necessary to carry out the provisions of his contract. Insofar as possible, the Contractor, in carrying out his work, must employ such methods or means as will not cause any interruption of or interference with the work of any other Contractor.

8. ADDENDA AND INTERPRETATIONS

No interpretation of the meaning of the plans, specifications or other prebid documents will be made to any bidder orally. All information given to bidders other than by means of the plans, specifications, or by addenda, as described below, is given informally and shall not be used as the basis of a claim against the Owner.

Every request for such interpretation should be in writing addressed to the Architect to be given consideration must be received at least seven (7) days prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications which, when issued, will be mailed by certified mail with return receipt requested to all prospective bidders (at the respective address furnished by them for such purposes), or sent via facsimile or email if time requires. Failure of any bidder to receive any such addendum or interpretation shall not relieve such bidder from any obligation under his bid as submitted. All addenda so issued shall become part of the Contract Documents.

9. SECURITY FOR FAITHFUL PERFORMANCE

Simultaneously with his delivery of the executed Contract, the Contractor shall furnish a surety bond or bonds as security for faithful performance of this contract and for the payment of all persons performing labor and materials under this contract. The surety on such bond or bonds shall be a surety company qualified to do business under the laws of the Commonwealth and satisfactory to the Owner. The bonds shall remain in force for one year after final acceptance of the work by the Owner, unless the Owner, in writing, releases the Contractor from the obligation sooner.

10. POWER OF ATTORNEY

Attorneys-in-fact who sign Contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

11. LAWS AND REGULATIONS

The bidder's attention is directed to the fact that all applicable State laws, municipal ordinances or bylaws, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the contract throughout, and they will be deemed to be included in the Contract the same as though written out in full.

12. LIQUIDATED DAMAGES FOR FAILURE TO ENTER INTO CONTRACT

The successful bidder, upon his failure or refusal to execute and deliver the Contract and bonds required within 10 days after presentation thereof by the Owner, shall forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposited with his/her bid, but the amount forfeited shall not exceed the difference between his/her bid price and the bid price of the next lowest responsible and eligible bidder. In case of death, disability, bona fide clerical or mechanical error of a substantial nature, or other similar unforeseen circumstances affecting the bidder, his/her bid deposit will be returned.

13. OBLIGATION OF BIDDER

At the time of the opening of bids, each bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the Contract Documents (including all addenda). The failure or omission of any bidder to examine any form, instrument, or document shall in no way relieve any bidder from any obligation in respect of his bid.

14. INFORMATION NOT GUARANTEED

All information given in the Contract Documents relating to subsurface and other conditions, natural phenomena, existing pipes, and other structures is from the best sources at present available to the Owner. All such information is furnished only for the information and convenience of bidders and is not guaranteed.

It is agreed and understood that the Owner does not warrant or guarantee that the subsurface or other conditions, natural phenomena, existing pipes, or other structures encountered during construction will be the same as those indicated in the Contract Documents. It is further agreed and understood that no bidder or Contractor shall use or be entitled to use any of the information made available to him or obtained in any examination made by him in any manner as a basis of or ground for any claim or demand against the Owner or the Architect/Engineer, arising from or by reason of any variance which may exist between the information made available and the actual subsurface or other structures actually encountered during the construction work, except as may otherwise be expressly provided for in the Contract Documents.

15. BID SECURITY

Each bid and sub-bid must be accompanied by bid security in the form of a certified check, a bid bond, cash, or a treasurer's or cashier's check, payable to the Owner, in the amount of five (5) percent of the value of the bid. Such security of general bidders will be returned to all except the three lowest responsible and eligible bidders within five days, Saturdays, Sundays, and legal holidays excluded, after the opening of bids, and the remaining securities will be returned promptly

after the Owner and the accepted bidder have executed the Contract, or if no notice of intent to award has been presented to the selected contractor within 30 days, Saturdays, Sundays and holidays excluded, after the date of the opening of bids, upon demand of the bidder at any time thereafter.

16. RIGHT TO REJECT BID

The Owner reserves the right to waive any informalities in bids and to reject any and all bids, should the Owner deem it to be in the public interest to do so.

The Owner may also reject bids which in its sole judgment are either incomplete, conditional, obscure or not responsive or which contain additions not called for, erasures not properly initialed, alterations, or similar irregularities.

17. TIME FOR COMPLETION

The successful general bidder must agree to commence work within ten (10) days of the date of the Notice to Proceed and to fully complete the project within the time limit stated in "Section 01 11 00 – Summary of Work."

18. COMPARISON OF BIDS

Bids will be compared on the basis of prices set forth in the bid forms. In the event that there is a discrepancy between the lump sum or unit prices written in words and figures, the prices written in words will govern.

19. AWARD OF CONTRACT

The Contract will be awarded to "the lowest responsible and eligible bidder" pursuant to General Laws Chapter 149, Section 44A (2), as amended. Such a bidder shall possess the skill, ability and integrity necessary for the faithful performance of the work, shall be able to furnish labor that can work in harmony with all other elements of labor employed, or to be employed, in the work, and shall otherwise comply with all applicable provisions of law. Contract award shall be subject to availability of an appropriation for funding.

20. STATUTES REGULATING COMPETITIVE BIDDING

Any bid which does not comply with the provisions of Massachusetts General Laws Chapter 149, Sections 44A through 44H, as amended, need not be accepted and the Owner may reject every such bid.

21. WAGE RATES

Prevailing Wage Rates as determined by the Commissioner of Department of Labor and Workforce Development under the provision of the Massachusetts General Laws, Chapter 149, Section 26 to 27G, as amended, apply to this project. It is the responsibility of the bidder, before bid opening, to request any additional information on Prevailing Wage Rates for those tradespeople who may be employed for the proposed work under this contract.

22. CONTRACTOR RECORDS

The Contractor shall comply with the provisions of Massachusetts General Laws, Chapter 30, Section 39R concerning Contractor records.

23. INSURANCE

The Contractor shall carry and continuously maintain until completion of the Contract, insurance as specified in Agreement and in such form as shall protect him performing work covered by this Contract, and the Town of Stow and its employees, agents and officials, from all claims an liability for damages for bodily injury, including accidental death, and for property damage, which may arise from operations under this Contract. The Town shall be named as an additional insured. The Contractor covenants and agrees to hold the Town and its employees, agents and officials harmless

from loss or damage due to claims for bodily injury or death and/or property damage arising from, or in connection with, operations under this Contract.

24. PROJECT MANAGER

The Owner may utilize the services of a project manager, whose duties shall be as set forth in an Agreement for Project Manager Services.

END OF SECTION

SECTION 00 31 19 – EXISTING CONDITIONS

A. Before submitting a bid, the Contractor shall make a thorough examination of the conditions at the site, checking the requirements of the Plans and Specifications with the existing conditions.
B. No claim for extra compensation or extension of time will be allowed because of the Contractor's failure to properly estimate the quantities, measurements, locations and site complexities of all items required to complete the Work which could be discerned from visiting the site and observing the extent of existing conditions.
C. During the bidding period, the Contractor shall report any discrepancies immediately to the Architect and request a written interpretation. In the absence of any such requests, the Contractor certifies that the conditions at the site are properly represented by the scope of Work described by the Plans and Specifications as prepared by the Architect.
D. Asbestos and hazardous materials abatement are part of this contract. The Contractor shall retain a licensed abatement contractor for the removal of any asbestos containing materials as identified or encountered during this project.

END OF SECTION

SECTION 00 41 13 - BID FORM – STIPULATED SUM
FORM OF GENERAL BID

Bid of _____ (hereinafter called "Bidder")*

(____) a corporation, organized and existing under the laws of the state of _____

(____) a partnership

(____) a joint venture

(____) an individual
doing business as _____

To the Town of Stow, Massachusetts (hereinafter called "Owner" or “Awarding Authority”).

Gentlemen:

A) The Bidder, in compliance with your invitation for bids for the Stow Town Hall Restoration, having examined the plans and specifications with related documents and the site of the proposed work, and being familiar with all of the conditions surrounding the construction of the proposed project including the availability of materials and labor, hereby proposes to furnish all labor, materials, and supplies, and to construct the project in accordance with the contract documents within the time set forth below, and at the prices stated below. These prices are to cover all expenses incurred in performing the work required under the contract documents, of which this proposal is a part.

The Bidder hereby agrees to commence work under this contract on or before a date to be specified in written "Notice to Proceed" of the Owner, and to fully complete the project no later than the date established in Section 01 11 00 Summary of Work.

To the Awarding Authority:

The Undersigned proposes to furnish all labor and materials required for the aforementioned Project in accordance with the accompanying plans and specifications prepared by Mills Whitaker Architects LLC for the contract price specified below, subject to additions and deductions according to the terms of the specifications.

_____
*Insert corporation, partnership or individual as applicable.

FORM OF GENERAL BID

NAME OF BIDDER: _____

B) Bidder acknowledges receipt of the following addenda:

No. _____ Dated: _____ No. _____ Dated: _____

No. _____ Dated: _____ No. _____ Dated: _____

C) The Bidder agrees to perform the bid work described in the specifications and shown on the plans for the following contract price: $_____.

For Alternate No._____ Add $_____; or Subtract $_____

For Alternate No._____ Add $_____; or Subtract $_____

For Alternate No._____ Add $_____; or Subtract $_____

For Alternate No._____ Add $_____; or Subtract $_____

D) The subdivision of the proposed contract price is as follows:

Item 1. The work of the general contractor, being all work other than that covered by Item 2.

$_____

Item 2. Sub-bids as follows:--

Sub-trade	Name of Sub-bidder	Amount	Bonds required, indicated by "Yes" or "No"
_____	_____	$_____	_____
_____	_____	$_____	_____
_____	_____	$_____	_____
_____	_____	$_____	_____
_____	_____	$_____	_____
_____	_____	$_____	_____
_____	_____	$_____	_____
_____	_____	$_____	_____
_____	_____	$_____	_____
_____	_____	$_____	_____
_____	_____	$_____	_____
_____	_____	$_____	_____
_____	_____	$_____	_____
_____	_____	$_____	_____
	Total of Item 2:	$_____	

The undersigned agrees that each of the above named sub-bidders will be used for the work indicated at the amount stated, unless a substitution is made. The undersigned further agrees to pay the premiums for the performance and payment bonds furnished by sub-bidders as requested herein and that all of the cost of all such premiums is included in the amount set forth in Item 1 of this bid.

FORM OF GENERAL BID

NAME OF BIDDER: _____

The undersigned agrees that if he is selected as general contractor, he will promptly confer with the awarding authority on the question of sub-bidders; and that the awarding authority may substitute for any sub-bid listed above a sub-bid filed with the awarding authority by another sub-bidder for the sub-trade against whose standing and ability the undersigned makes no objection; and that the undersigned will use all such finally selected sub-bidders at the amounts named in their respective sub-bids and be in every way as responsible for them and their work as if they had been originally named in this general bid, the total contract price being adjusted to conform thereto.

E) References: List of all projects completed within the last five (5) years. Attach additional pages if necessary.

Name of Project	Location	Contact Person	Phone/Email
1.			
2.			
3.			
4.			
5.			

F) Unit Prices: Submit “Unit Prices Schedule” per Section 01 22 00 – Unit Prices, as requested.

G) The undersigned agrees that, if he is selected as general contractor, he will within five days, Saturdays, Sundays and legal holidays excluded, after presentation thereof by the awarding authority, execute a contract in accordance with the terms of this bid and furnish a performance bond and also a labor and materials or payment bond, each of a surety company qualified to do business under the laws of the commonwealth and satisfactory to the awarding authority and each in the sum of the contract price, the premiums for which are to be paid by the general contractor and are included in the contract price; provided, however, that if there is more than one surety company, the surety companies shall be jointly and severally liable.

The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work; that all employees to be employed at the worksite will have successfully completed a course in construction safety and health approved by the United States Occupational Safety and Health Administration that is at least 10 hours in duration at the time the employee begins work and who shall furnish documentation of successful completion of said course with the first certified payroll report for each employee; and that he will comply fully with all laws and regulations applicable to awards made subject to section 44A.

The undersigned further certifies under the penalties of perjury that this bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this subsection the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity. The undersigned further certifies under penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the commonwealth under the provisions of section twenty-nine F of chapter twenty-nine, or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated thereunder.

FORM OF GENERAL BID

NAME OF BIDDER: _____

The Undersigned hereby certifies, under the pains and penalties of perjury, that the foregoing bid is based upon the payment to laborers to be employed on the project of wages in an amount no less than the applicable prevailing wage rates established for the project by the Massachusetts Department of Labor and Workforce Development. The undersigned bidder agrees to indemnify the awarding authority for, from and against any loss, expense, damages, actions or claims, including any expense incurred in connection with any delay or stoppage of the project work, arising out of or as a result of (1) the failure of the said bid to be based upon the payment of the said applicable prevailing wage rates or (2) the failure of the bidder, if selected as the contractor, to pay laborers employed on the project the said applicable prevailing wage rates.

The Undersigned acknowledges the stringent requirements of the Owner with respect to the date of Substantial Completion for the Work, and recognizes that the construction schedule may require that work proceed on an accelerated basis. The Bidder therefore agrees that the Work of his own forces and of his Sub-bidders, including all Filed Sub-bidders, shall be performed on an overtime and/or double-shift basis if and to the extent necessary in order that the construction schedule be met. Neither overtime nor double-shift work shall be grounds for any claims for compensation to the Bidder or to any Sub-bidder. None of the requirements herein shall be construed as relieving the Bidder of his responsibility to conduct his operations in conformance with local ordinances or requirements established by the Commonwealth.

Pursuant to M.G.L. Chapter 62C, Section 49A, I certify under the penalties of perjury that I, to my best knowledge and belief, have filed all state tax returns and paid all State Taxes required under law.

Respectfully submitted:

Date:_____

By: _____
(Signature)

_____
(Name of Bidder)

(SEAL - if bid is by
a corporation)

_____
(Title)

_____
(Business Address)

_____
(Town and State)

_____
(Telephone Number)

Note: This bid shall bear the written signature of the bidder,

1. If the bidder is an individual, provide residential address if different from business address.
2. If the bidder is a partnership, the bid must be signed by a partner and provide full names and residential addresses of all partners.
3. If the bidder is a corporation, the bid must be signed by a duly authorized officer or agent of the corporation, the state of incorporation must be provided, and the corporate seal must be affixed. Provide the state of incorporation and the names of all corporate officers.

FORM OF SUB-BID

NAME OF SUB-BIDDER: _____

To all Bidders Except those Excluded:

A. The Undersigned proposes to furnish all labor and materials required for completing, in accordance with the hereinafter described plans, specifications and addenda, all the work specified in Section No._____ of the specifications and in any plans specified in such section, prepared by Mills Whitaker Architects LLC for the Stow Town Hall Restoration in Stow Massachusetts, for the contract sum of

_____ dollars ($_____).

For Alternate No._____ Add $_____; or Subtract $_____

For Alternate No._____ Add $_____; or Subtract $_____

For Alternate No._____ Add $_____; or Subtract $_____

For Alternate No._____ Add $_____; or Subtract $_____

B. This sub-bid includes addenda numbered_____.

C. This sub-bid

__ may be used by any general bidder except:
_____
_____

__ may only be used by the following general bidders:
_____
_____

[To exclude general bidders, insert "X" in one box only and fill in blank following that box. Do not answer C if no general bidders are excluded.]

D. The undersigned agrees that, if he is selected as a sub-bidder, he will, within five days, Saturdays, Sundays and legal holidays excluded, after presentation of a subcontract by the general bidder selected as the general contractor, execute with such general bidder a subcontract in accordance with the terms of this sub-bid, and contingent upon the execution of the general contract, and, if requested so to do in the general bid by such general bidder, who shall pay the premiums therefor, furnish a performance and payment bond of a surety company qualified to do business under the laws of the commonwealth and satisfactory to the awarding authority, in the full sum of the subcontract price.

E. The names of all persons, firms and corporations furnishing to the undersigned labor or labor and materials for the class or classes or part thereof of work for which the provisions of the section of the specifications for this sub-trade require a listing in this paragraph, including the undersigned if customarily furnished by persons on his own payroll and in the absence of a contrary provision in the specifications, the name of each such class of work or part thereto and the bid price for such class of work or part thereof are:

FORM OF SUB-BID

NAME OF SUB-BIDDER: _____

Name	Class of Work	Bid Price
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

[Do not give bid price for any class or part thereof furnished by undersigned.]

F. The undersigned agrees that the above list of bids to the undersigned represents bona fide bids based on the hereinbefore described plans, specifications and addenda and that, if the undersigned is awarded the contract, they will be used for the work indicated at the amounts stated, if satisfactory to the awarding authority.

G. The undersigned further agrees to be bound to the general contractor by the terms of the hereinbefore described plans, specifications, including all general conditions stated therein, and addenda, and to assume toward him all the obligations and responsibilities that he, by those documents, assumes toward the owner.

H. The undersigned offers the following information as evidence of his qualifications to perform the work as bid upon according to all the requirements of the plans and specifications:

1. Have been in business under present business name _____ years.

2. Ever failed to complete any work awarded: _____

3. List one or more recent buildings with names of the general contractor and architect on which you served as a subcontractor for work of similar character as required for the above-named building.

Building	Designer	General Contract	Amount of Contract
(a)_____	_____	_____	_____
(b)_____	_____	_____	_____
(c)_____	_____	_____	_____

4. Bank reference_____

FORM OF SUB-BID

NAME OF SUB-BIDDER: _____

I. The undersigned hereby certifies that he is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work and that he will comply fully with all laws and regulations applicable to awards of subcontracts subject to section forty-four F.

The undersigned further certifies under penalties of perjury that this sub-bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this subsection the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity. The undersigned further certifies under penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the commonwealth under the provisions of section twenty-nine F of chapter twenty-nine, or any other applicable debarment provisions of any other chapter of the General Law or any rule or regulation promulgated thereunder.

The Undersigned hereby certifies, under the pains and penalties of perjury, that the foregoing bid is based upon the payment to laborers to be employed on the project of wages in an amount no less than the applicable prevailing wage rates established for the project by the Massachusetts Department of Labor and Industries. The undersigned bidder agrees to indemnify the awarding authority for, from and against any loss, expense, damages, actions or claims, including any expense incurred in connection with any delay or stoppage of the project work, arising out of or as a result of (1) the failure of the said bid to be based upon the payment of the said applicable prevailing wage rates of (2) the failure of the bidder, if selected as the contractor, to pay laborers employed on the project the said applicable prevailing wage rates.

Date:_____

_____
(Name of Sub-bidder)

By:_____
(Title and Name of Person
Signing Bid)

_____
(Business Address)

_____
(Town and State)

Note: This bid shall bear the written signature of the bidder,

1. If the bidder is an individual, provide residential address if different from business address.
2. If the bidder is a partnership, the bid must be signed by a partner and provide full names and residential addresses of all partners.
3. If the bidder is a corporation, the bid must be signed by a duly authorized officer or agent of the corporation, the state of incorporation must be provided, and the corporate seal must be affixed. Provide the state of incorporation and the names of all corporate officers.

SECTION 00 43 43 – WAGE RATES FORM

The following classifications and wage rates apply to this project as established by the:

Commonwealth of Massachusetts
Department of Labor and Workforce Development
Division of Occupational Safety

A. PREVAILING WAGE RATES – **Not Yet Requested (need bid date established)**.

B. WEEKLY STATEMENT OF COMPLIANCE – one (1) page.

C. WEEKLY CERTIFIED PAYROLL REPORT FORM – one (1) page.

WEEKLY PAYROLL RECORDS REPORT
& STATEMENT OF COMPLIANCE

In accordance with Massachusetts General Law c. 149, §27B, a true and accurate record must be kept of all persons employed on the public works project for which the enclosed rates have been provided. A Payroll Form has been printed on the reverse of this page and includes all the information required to be kept by law. Every contractor or subcontractor is required to keep these records and preserve them for a period of three years from the date of completion of the contract.

In addition, every contractor and subcontractor is required to submit a copy of their weekly payroll records to the awarding authority. This is required to be done on a weekly basis. Once collected, the awarding authority is also required to preserve those records for three years from the date of completion of the project.

Each such contractor or subcontractor shall furnish to the awarding authority directly within 15 days after completion of its portion of the work, a statement, executed by the contractor, subcontractor or by any authorized officer thereof who supervised the payment of wages, this form.

STATEMENT OF COMPLIANCE

_____, 20_____

I,_____,_____
(Name of signatory party) (Title)

do hereby state:

That I pay or supervise the payment of the persons employed by
_____ on the _____
(Contractor, subcontractor or public body) (Building or project)

and that all mechanics and apprentices, teamsters, chauffeurs and laborers employed on said project have been paid in accordance with wages determined under the provisions of sections twenty-six and twenty-seven of chapter one hundred and forty nine of the General Laws.

Signature _____
Title _____

MASSACHUSETTS WEEKLY CERTIFIED PAYROLL REPORT FORM

mpany's Name:	Address:	Phone No.:	Payroll No.:

ployer's Signature:	Title:	Contract No:	Tax Payer ID No.	Work Week Ending:

arding Authority's Name:	Public Works Project Name:	Public Works Project Location:	Min. Wage Rate Sheet No.

neral / Prime Contractor's Name:	Subcontractor's Name:	"Employer" Hourly Fringe Benefit Contributions

ployee Name & Complete Address	Employee is OSHA 10 Certified (?)	Work Classification:	Appr. Rate (%)	Hours Worked Su.	Mo.	Tu.	We.	Th.	Fr.	Sa.	Project Hours (A) / All Other Hours	Hourly Base Wage (B)	Health & Welfare Insurance (C')	ERISA Pension Plan (D)	Supp. Unemp. (E)	(B+C+D+E) Total Hourly Prev. Wage (F)	(A x F) Project Gross Wages (G) / Total Gross Wages	Check No. (H)

OTE: Pursuant to MGL Ch. 149 s.27B, every contractor and subcontractor is required to submit a "true and accurate" copy of their weekly payroll records directly to the awarding authority. Failure to comply may result in the commencement of a criminal action or the issuance of a civil citation.

Page _____ of _____

Date recieved by awarding authority
/ /

SECTION 00 52 13 – AGREEMENT FORM / STIPULATED SUM

THIS AGREEMENT made this _____ day of _____

in the year Two Thousand and Twenty Two, between _____,

with a usual place of business at _____,

hereinafter called the CONTRACTOR, and the Town of Stow acting by its Select Board, with a usual place of business at 380 Great Road, Stow, MA 01775, hereinafter called the OWNER.

The CONTRACTOR and the OWNER, for the consideration hereinafter named, agree as follows:

1. Scope of Work

The Contractor shall furnish all labor, materials, equipment and insurance to perform all Work required for the project known as the Stow Town Hall Restoration Project, in strict accordance with the Contract Documents and all related Drawings and Specifications. The said Documents, Specifications, Drawings and any supplemental general conditions are incorporated herein by reference and are made a part of this Agreement.

2. Contract Price

The Owner shall pay the Contractor for the performance of this Agreement, subject to additions and deductions provided herein, in current funds, the sum of
_____.

3. Commencement and Completion of Work

It is agreed that time is of the essence of this Agreement. The Contractor shall commence and prosecute the Work under this Agreement upon execution hereof and shall complete the Work on or before the date established in the Project Manual, Section 01 11 00 – Summary of Work.

A. Definition of Term: The Term "Substantial Completion" shall mean the date certified by the Owner when construction is sufficiently complete, in accordance with the Contract Documents, so the Owner may occupy the project, or designated portion(s) thereof, for the use for which it is intended.

B. Time as Essential Condition: It is understood and agreed that the commencement of and substantial completion of the Work are essential conditions of this Agreement. It is further agreed that time is of the essence for each and every portion of the Contract Documents wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the Contract Documents any additional time is allowed for the completion of any Work, the new time fixed by such extension shall be of the essence of this Agreement. It is understood and agreed that the times for the completion of the Work are reasonable, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.

C. Progress and Completion: Contractor shall commence Work promptly upon execution of this Agreement and shall prosecute and complete the Work regularly, diligently and uninterruptedly at such a rate of progress as will insure Substantial Completion within the stipulated number of calendar days.

4. Performance of the Work

A. Direction of the Work: The Contractor shall supervise and direct the Work, using his best skills and attention which shall not be less than such state of skill and attention generally rendered by the contracting profession for projects similar to the Project in scope, difficulty and location. The Contractor shall maintain adequate supervisory personnel at the project site during the performance of the Work. He shall be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Agreement.

B. Responsibility for the Work: (1) The Contractor shall be responsible to the Owner for the acts and omissions of his employees, Subcontractors and their agents and employees, and other persons performing any of the Work under a contract with the Contractor. This obligation shall also extend to the presence on the Site of suppliers of materials or equipment, their employees, contractors, and agents engaged in the Work.

(2) The Contractor shall not be relieved from his obligations to perform the Work in accordance with the Contract Documents either by the activities or duties of the Owner in its administration of the Agreement, or by inspections, tests or approvals required or performed by persons other than the Contractor.

C. Permits and Fees: Unless otherwise expressly provided, the Contractor shall secure and pay for all permits and fees, licenses and inspections necessary for the proper execution and completion of the Work which are customarily secured after execution of the Agreement and which are legally required at the time the bids are received, and the same shall at all times be the property of the Owner and shall be delivered to the Owner upon completion of the Project.

D. Notices, Compliance With Laws: (1) The Contractor shall give all notices and comply with all federal, state and local laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the performance of the Work. The Contractor shall provide the Owner with reproductions of all permits, licenses and receipts for any fees paid. The Owner represents that it has disclosed to the Contractor all orders and requirements known to the Owner of any public authority particular to this Agreement.

(2) If the Contractor observes that any of the Contract Documents are at variance with applicable laws, statutes, codes and regulations in any respect, he shall promptly notify the Owner in writing, and any necessary changes shall be accomplished by appropriate modification.

(3) If the Contractor performs any Work which he knows or should know is contrary to such laws, ordinances, rules and regulations, and without such notice to the Owner, he shall assume full responsibility therefor and shall bear all costs attributable thereto.

(4) In the performance of the Work, the Contractor shall comply with all applicable federal, state and local laws and regulations including those relating to workplace and employee safety. The Contractor shall notify the Owner immediately of any conditions at the place of the Work which violate said laws and regulations and shall take prompt action to correct and eliminate any such violations.

E. Project Superintendent: The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site at all times during the progress of the Work. The superintendent shall represent the Contractor and all communications given to the superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be so confirmed on written request in each case.

F. Progress Schedule: The Contractor, immediately after being awarded the Contract, shall prepare and submit for the Owner's information an estimated progress schedule for the Work. The progress schedule shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

G. Drawings, Specifications and Submittals:

(1) The Contractor shall maintain at the site for the Owner one record copy of all Drawings, Specifications, Addenda, Change Orders and other Modifications, and "As-Built" Drawings and Specifications in good order and marked currently to record all changes made during construction, and approved Shop Drawings, Product Data and Samples. These shall be delivered to the Owner upon completion of the Work.

(2) By approving and submitting Shop Drawings, Product Data and Samples, the Contractor represents that he has determined and verified all materials, field measurements, and field construction criteria related thereto, or will do so, and that he has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

(3) The Contractor shall not be relieved of responsibility for any deviation from the requirements of the Contract Documents by the Owner's approval of Shop Drawings, Product Data or Samples unless the Contractor has specifically informed the Owner in writing of such deviation at the time of submission and the Owner has given written approval to the specific deviation. The Contractor shall not be relieved from responsibility for errors or omissions in the Shop Drawings, Product Data or Samples by the Owner's approval thereof.

(4) The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data or Samples, to revisions other than those requested by the Owner on previous submittals.

(5) No portion of the Work requiring submission of a Shop Drawing, Product Data or Sample shall be commenced until the submittal has been approved by the Owner. All such portions of the Work shall be in accordance with approved submittals.

H. Protection of the Work and Owner's Property: The Contractor shall at all times safely guard the Owner's property from injury or loss in connection with this Agreement. He shall at all times safely guard and protect his own Work, and that of adjacent property from damage. The Contractor shall replace or make good any such damage, loss or injury. The Contractor shall clean the Work area and restore it to its completed condition upon completion of the Work.

I. Quality of the Work: The Contractor shall perform the Work in a good, workmanlike manner. The Contractor hereby guarantees that the entire Work constructed by him under the Agreement will meet fully all requirements thereof as to quality of workmanship and materials. The Contractor hereby agrees to make at his own expense any repairs or

replacements made necessary by defects in materials or workmanship supplied to him that become evident within one (1) year after the date of the final payment, and to restore to full compliance with the requirements set forth herein any part of the Work constructed hereunder, which during said one (1) year period is found to be deficient with respect to any provisions of the Contract Documents. The Contractor also agrees to hold the Owner harmless from claims of any kind arising from damage due to said defects. The Contractor shall make all repairs and replacements promptly upon receipt of written orders for same from the Owner. If the Contractor fails to make the repairs and replacements promptly, the Owner may do the Work and the Contractor shall be liable to the Owner for the cost thereof.

J. Warranty: The Contractor guarantees to Owner that all materials incorporated into the Work will be new unless otherwise specified or agreed. Prior to final payment, the Contractor shall deliver to the Owner all manufacturers' warranties, together with such endorsements or assignments as are necessary to ensure to the Owner the full rights and benefits of such warranties.

5. Affirmative Action/Equal Employment Opportunity

The Contractor is directed to comply with all applicable State Laws, Ordinances, Bylaws, and rules and regulations regarding affirmative action/equal employment opportunity requirements. Failure of the Contractor to comply with any such law, rule or regulation shall constitute grounds for the Owner to terminate the Agreement.

6. Site Information Not Guaranteed; Contractor's Investigation

All information given in the Contract Documents relating to subsurface and other conditions, natural phenomena, existing pipes, and other structures is from the best sources at present available to the Owner. All such information is furnished only for the information and convenience of the Contractor and is not guaranteed.

It is agreed and understood that the Owner does not warrant or guarantee that the subsurface or other conditions, natural phenomena, existing pipes, or other structures encountered during construction will be the same as those indicated in the Contract Documents.

Contractor has familiarized himself with the nature and extent of the Contract Documents, Work, locality, and with all local conditions and federal, state, and local laws, rules, ordinances, and regulations that in any manner may affect costs, progress, or performance of the Work. Contractor has made, or has caused to be made, examinations, investigations, and tests and studies of such reports and related data in addition to those referred to in the paragraph above as he deems necessary for the performance of the Work at the Contract Price, within the Contract Time, and in accordance with the other Terms and Conditions of the Contract Documents; and no additional examinations, tests, investigations, reports, and similar data are or will be required by the Contractor for such purposes.

Contractor has correlated the results of all such observations, examinations, investigations, tests, reports, and data with the Contract Documents. Contractor has given the Owner written notice of all conflicts, errors, or discrepancies that he has discovered in the Contract Documents, and the resolution thereof by the Owner is acceptable to the Contractor.

It is further agreed and understood that the Contractor shall not use or be entitled to use any of the information made available to him or obtained in any examination made by him in any manner as a basis of or ground for any claim or demand against the Owner, arising from or by reason of any variance which may exist between the information made available and the actual subsurface conditions or other conditions or structures actually encountered during the

construction Work, except as may otherwise be expressly provided for in the Contract Documents.

7. Project Architect

There is a Project Architect for this project who is Mills Whitaker Architects LLC. Except as otherwise indicated in the Contract Documents, the Architect shall be a representative of the Owner and the Contractor shall direct all communications, questions and comments on the Work and the performance thereof to the Architect. Except as otherwise provided, the Architect shall have all the authority of the Owner set forth in the Contract Documents. In general, the Architect shall have the authority to review the performance of the Work, reject Work which is defective or otherwise does not comply with the Contract Documents and to order the Contractor to remedy defective Work and take such actions which are necessary to make the Work conform to the Contract Documents.

8. Wage Rates

Prevailing Wage Rates as determined by the Commissioner of the Department of Labor and Workforce Development under the provisions of Massachusetts General Laws, Chapter 149, Section 26 to 27G, as amended, apply to this project. It is the responsibility of the Contractor to provide the Town with certified payrolls and to comply with all requirements of the above-cited statutes.

The schedules of prevailing wage rates are included in the Contract Documents.

9. Payments to the Contractor

Within fifteen (15) days after receipt from the Contractor of a proper and satisfactory periodic estimate requesting payment of the amount due for the preceding month, the Owner shall have fifteen (15) days to make payment for:

A. The Work performed during the preceding month.

B. The materials not incorporated in the Work but delivered and suitably stored at the site (or at some location agreed upon in writing) to which the Contractor has title, or to which a Subcontractor has title and has authorized the Contractor to transfer title to the Owner.

C. Less the following retention items:

1. A retention based on an estimate of the fair value of the Owner's claims against the Contractor.

2. A retention for direct payments to Subcontractors, if any, based on demands for same in accordance with the provisions of Section 39F of Chapter 30 of the General Laws.

3. A retention not exceeding five percent (5%) of the approved amount of the periodic payment.

D. After the receipt of a periodic estimate requesting final payment and within sixty-five (65) days after the Contractor fully completes the Work, or substantially completes the Work so that the value of the Work remaining to be done is, on the estimate of the Owner, less than 1% of the original Contract Price, or substantially completes the Work and the Owner takes possession or occupancy, whichever occurs first, the Owner shall pay the Contractor the entire balance due on the Contract less:

1. A retention based on an estimate of the fair value of the Owner's claims against the Contractor and of the cost of completing the incomplete and unsatisfactory items of Work.

2. A retention for direct payments to Subcontractors, if any, based on demands of same in accordance with the provisions of Section 39F of Chapter 30 of the General Laws, or based on the record of payments by the Contractor to the Subcontractors under this Contract if such record of payment indicates that the Contractor has not paid Subcontractors as provided in Section 39F of Chapter 30 of the General Laws.

If the Owner fails to make payment as herein provided, there shall be added to each such payment, daily interest at the rate of 3 percentage points above the rediscount rate than charged by the Federal Reserve Bank of Boston, commencing on the first day after said payment is due, and continuing until the payment is delivered or mailed to the Contractor; provided that no interest shall be due, in any event, on the amount of a periodic estimate for final payment until fifteen (15) days after receipt of such a periodic estimate by the Owner as provided in the first paragraph of this Article. The Contractor agrees to pay to each subcontractor a portion of any such interest paid in accordance with the amount due each subcontractor.

The Owner may make changes in any periodic estimate submitted by the Contractor and the payment due on said periodic estimate shall be computed in accordance with the changes so made, and such changes and any requirements for a corrected periodic estimate shall not affect the due date for the periodic payment or the date for the commencement of interest charges on the amount of the periodic payment computed in accordance with the changes made, as provided herein; provided further, that the Owner may, within seven (7) days after receipt, return to the Contractor for correction, any periodic estimate which is not in acceptable form or which contains computations not arithmetically correct, and in that event, the date of receipt of such periodic estimate shall be the date of receipt of the corrected periodic estimate in proper form and with arithmetically correct computations. The date of receipt of a periodic estimate received on a Saturday shall be the first working day thereafter.

E. Changes in the Work: No changes in the Work covered by the approved Contract Documents shall be made without prior written approval of the Owner. Charges or credits for the Work covered by the approved change shall be determined by one or more, or a combination of the following methods:

(a) Unit bid prices previously approved.

(b) An agreed lump sum.

(c) The actual cost of:

(1) Labor.

(2) Materials entering permanently into the Work.

(3) The ownership or rental cost of construction equipment during the time of use on the extra Work.

(4) Power and consumable supplies for the operation of power equipment.

(5) Wages to be paid.

To the cost under (c) there shall be added a fixed fee to be agreed upon but not to exceed fifteen percent (15%) of the actual cost of Work. The fee shall be compensation to cover the cost of supervision, overhead, bond, profit and any other general expenses.

F. Claims for Additional Costs: If the Contractor wishes to make a claim for an increase in the Contract Sum, he shall give the Owner written notice thereof within twenty days after the occurrence of the event giving rise to such claim. This notice shall be given by the Contractor before proceeding to execute the Work, except in an emergency endangering life or property. No such claim shall be valid unless so made. Any change in the Contract Sum resulting from such claim shall be authorized by Change Order.

The Contractor hereby agrees that the Contractor shall have no claim for damages of any kind against the Town on account of any delay in the commencement or performance of the Work and/or any hindrance, delay or suspension of any portion of the Work including, but not limited to, any claims or damages on account of having to perform out of sequence Work, claims for damages on account of loss of production or other interference with the Work whether such delay is caused by the Town or otherwise, except as and to the extent expressly provided under G.L. c.30, §39O in the case of written orders by the Town. The Contractor acknowledges that the Contractor's sole remedy for any such claim will be an extension of time as provided herein.

10. Final Payment, Effect

The acceptance of final payment by the Contractor shall constitute a waiver of all claims by the Contractor arising under the Agreement.

11. Contract Documents

The Contract Documents consist of the following, together with this Agreement:

Invitation to Bid
Instructions to Bidders
This Contract Form
Bid Form
Performance Bond
Labor & Materials Payment Bond
Non-Collusion Certificate
Tax Compliance Certificate
Clerk's Certificate of Corporate Vote
Certificate of Insurance
General Conditions
Supplementary General Conditions
General Requirements
Specifications and Addenda
Contract Drawings
Schedule of Prevailing Wages

12. Terms Required By Law

This Agreement shall be considered to include all terms required to be included in it by the Massachusetts General Laws, and all other laws, as though such terms were set forth in full herein.

13. Indemnification

The Contractor shall indemnify and hold harmless the Owner from and against any and all claims, damages, losses, and expenses, including attorney's fees, arising out of the performance of this Agreement when such claims, damages, losses, and expenses are caused, in whole or in part, by the acts, errors, or omissions of the Contractor or his employees, agents, subcontractors or representatives.

14. Insurance

The Contractor shall purchase and maintain such insurance as will protect both the Owner and the Contractor from claims which may arise under the Agreement, including operations performed for the named insured by independent contractors and general inspection thereof by the named insured. In addition, the Contractor shall require its subcontractors to maintain such insurance. Coverage shall be provided for:

.1 claims under workers' or workmen's compensation, disability benefit and other applicable employee benefit acts;

.2 claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;

.3 claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;

.4 claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by the Contractor, or (2) by any other person;

.5 claims for damages, including damages to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom; and

.6 claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

.7 claims involving contractual liability applicable to the Contractor's obligations under Article 13.

The limits of liability for coverage required under the preceding paragraph shall be as Specified in the Supplementary Conditions.

Except for Workmen's Compensation, all liability coverage shall name the Town as an additional insured and shall provide for 30 days prior written notice to the Town of any modification or termination of coverage provided thereby. The Contractor shall provide the Owner with appropriate certificate(s) of insurance evidencing compliance with this provision prior to the commencement of any Work under this Agreement.

15. Notice

All notices required to be given hereunder shall be in writing and delivered to, or mailed first class to, the parties' respective addresses stated above. In the event that immediate notice is required, it may be given by telephone or facsimile, but shall, to the extent possible, be followed by notice in writing in the manner set forth above.

16. Termination

A. Each party shall have the right to terminate this Agreement in the event of a failure of the other party to comply with the terms of the Agreement. Such termination shall be effective upon seven days' notice to the party in default and the failure within that time of said party to cure its default.

B. The Owner shall have the right to terminate the Agreement without cause, upon ten (10) days' written notice to the Contractor. In the event that the Agreement is terminated pursuant to this subparagraph, the Contractor shall be reimbursed in accordance with the Contract Documents for all Work performed up to the termination date, and for all materials or equipment not incorporated in the Work, but delivered and suitably stored at the site. Payment for material or equipment stored at the site shall be conditioned upon submission by the Contractor of bills of sale or such other evidence as is satisfactory to Owner to establish the Owner's title to such material or equipment or otherwise protect the Owner's interests.

17. Miscellaneous

A. Royalties and Patents: The Contractor shall pay all royalties and license fees. He shall defend all suits or claims for infringement of any patent rights and shall save the Owner harmless from loss on account thereof, except that the Owner shall be responsible for all such loss when a particular design, process or the product of a particular manufacturer or manufacturers is specified; but if the Contractor believes or has reason to believe that the design, process or product specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives such information to the Owner, and thereafter the Owner insists on the use of the design, process or products specified.

B. Assignment: The Contractor shall not assign or transfer any of its rights, duties or obligations under this Agreement without the written approval of the Owner.

C. Governing Law: This Agreement shall be governed by and construed in accordance with the law of the Commonwealth of Massachusetts.

D. By its signature hereon, the Contractor certifies, under the pains and penalties of perjury, that it has complied with all laws of the Commonwealth of Massachusetts relating to taxes, reporting of employees and contractors, and withholding and remitting child support.

[Remainder of page intentionally blank.]

AGREED:

TOWN OF STOW, MASSACHUSETTS
(Owner)

By its **Town Administrator**

By_____
(Signature)

_____
(Printed Name)

_____
(Title)

CONTRACTOR: _____
(Company)

By_____
(Signature)

_____
(Printed Name)

_____
(Title)

_____
(Address)

_____
(City and State)

Approved as to Form:

By_____
(Owner's Counsel)

In accordance with G.L. c.44, Section 31C, this is to certify that an appropriation in the amount of this contract is available therefor and that the _____ has been authorized to execute the contract and approve all requisitions and change orders.

By_____
(Owner's Accountant)

_____
(Name)

END OF SECTION

SECTION 00 65 19 – CERTIFICATE OF COMPLETION FORMS

A. The Affidavit for Payment of Debts and Claims Form to be used for the Contract shall be AIA Document G706-1994 *Affidavit of Payment of Debts and Claims.*

B. The Affidavit of Release of Liens Form to be used for the Contract shall be AIA Document G706A-1994 *Affidavit of Release of Liens*

C. The Certificate of Substantial Completion Form to be used for the Contract shall be AIA Document G704-2000 *Certificate of Substantial Completion.*

D. The Contractor should be thoroughly familiar with these documents prior to submitting a bid.

E. Refer also to Section 01 77 00 – Closeout Procedures for additional information regarding project completion.

END OF SECTION

SECTION 00 72 13 – GENERAL CONDITIONS (Stipulated Sum)

A. The General Conditions for the Project shall be AIA Document A201-2017 *General Conditions of the Contract for Construction*.

B. A copy of this document may be reviewed in draft form from The American Institute of Architects "Documents-on-Demand" website:
https://www.aiacontracts.org/

END OF SECTION

PART B

SPECIFICATIONS

SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.01 PROJECT DESCRIPTION

A. The Work under the Contract consists of:
   1. This rehabilitation project is intended to make the building handicap accessible, replace existing electrical and mechanical systems, improve life safety and enhance facility usability.
   2. The Stow Town Hall was constructed in 1848 in the center of Stow. In 1895, an ell was built on the south side to increase municipal office space on two levels.
   3. In 1989, a larger "Town Building" was constructed across Great Road as a municipal government faciltiy. Since that time, the former Town Hall's use has been to serve as a community center for myriad functions.
   4. The historically significant building is eligible for listing in the National Register of Historic Places as an individual building or as part of a local historic district.

B. The Project scope is described in the Drawings and Project Manual.

1.02 PROJECT SCHEDULE

A. The Work shall commence immediately upon execution of an Owner-Contractor Agreement. The dates for Commencement and Substantial Completion will be stated in the Owner-Contractor Agreement and will generally be as follows:
   1. Project Commencement: July 1, 2022.
   2. Substantial Completion: May 1, 2023.
   3. Building Re-Opens to the Public: June 15, 2023.

B. The Owner will not occupy the building during construction.
   1. The existing water service to the building is part of a public water supply that serves this building and traverses inside the building to continue beyond it for the provision of potable water to other builidngs in Stow Center, including the Library. The General Contractor shall maintain continuous operation of this water service during construction, taking whatever temporary measures are necessary so that the other buildings served by this source are never without water.
   2. The oil fired hot air furnace heating system will be removed in its entirety. The General Contractor shall provide a temporary heating system during construction. The former gas service, which is no longer active, shall be removed as part of the project, but the Contractor can elect to re-introduce this service on a temporary basis if desired during construction.
   3. The electrical service and all electrical systems will be completely replaced, upgraded and relocated as indicated in the Drawings. The Electrical Sub shall provide a temporary electrical system and lighting during construction.
   4. Communication systems (telephone, internet, fiber optics) shall be removed from within the building and new services shall be provided. Overhead cabling from the Town Building (via Stow TV) to the balcony and Great Hall shall be relocated and extended to meet the renovation requirements as noted on the Drawings.
   5. The fire alarm system will be completely replaced. The Electrical Subcontractor shall provide a temporary fire alarm system during construction.
   6. The Owner shall pay for all utilities during the construction period, including utility backcharges as applicable. The Contractor shall make every effort to conserve resources to the extent possible.

C. The Owner and Contractor will strive to cooperate with one another fully in every respect so that the ongoing Work may proceed in an efficient manner to the benefit of both the Owner and the Contractor.

1.03 PERMITS, ZONING AND VARIANCES

A. PERMITS: Obtain any and all permits that may be required to perform the Work. Submit copies to the Owner and Architect.
   1. The Town will waive all permit fees issued by any municipal departments.
   2. Arrange for and pay the cost of any use of the sidewalk and street areas as may be needed. Arrange for and pay the cost of any police details that may be required for successful completion of the Work.
B. ZONING: No zoning approvals are required for the Work.
C. VARIANCES: A variance decision has been obtained from the Massachusetts Architectural Access Board for full compliance with the current regulations (521 CMR) as is required based upon the nature and scope of the Work. A copy of the variance decision will be provided to the Contractor for information purposes.
D. HISTORICAL: The building is eligible for listing in the National Register of Historic Places, but is not part of a local historic district. A Certificate of Appropriateness from the Town is not required for the Project.

1.04 MISCELLANEOUS PROVISIONS

A. Tax Exempt: The Town of Stow is tax-exempt and will provide forms to the contractor for its use and for all its subcontractors use in purchasing for this project.
B. Codes / Inspections / Occupancy: Comply with applicable codes and regulations of authorities having jurisdiction. Submit copies of inspection reports, notices and similar communications to the Owner and Architect immediately upon receipt. Upon completion of the project, provide a copy of the Building Permit with all required signatures to the Architect and Owner for their records.
C. Coordination Drawings: The General Contractor shall review all submittal and layout drawings as prepared by each relevant subcontractor. Coordination drawings for the integration of all systems with finished surfaces and clearance requirements, to the extent needed for implementing the design intent of the project, shall be prepared by the General Contractor to insure appropriate integration of the Work. Each trade shall cooperate fully with the need for this coordination in advance of ordering, fabrication and installation of equipment, devices, piping, conduit, ductwork, valves, access panels, fixtures, finishes and all other components of the Work.
D. Dimensions: Verify dimensions indicated on Drawings with field dimensions before fabrication or ordering of materials. Do not scale Drawings. If dimensions on the Drawings are not sufficient to define the location of a component, notify the Architect and request an interpretation of the intent via sketches or field discussions.
E. Existing Conditions: Notify the Architect of existing conditions differing from those indicated on the Drawings.
   1. Do not remove or alter structural components without prior written approval.
F. Definitions for terms used in the plans and specifications:
   1. Provide: Furnish and install, complete with all necessary accessories, ready for intended use. Pay for all related costs.
   2. Approved: Acceptance of item submitted for approval. Not a limitation of release from compliance with the Contract Documents or regulatory requirements. Refer to limitations of 'Approved' in General and Supplementary Conditions. Refer also to Section 01 33 00 Submittal Procedures.
   3. Match Existing: Match existing material, quality, texture, color, profile and any other relevant features as acceptable to the Architect.
G. Intent: Drawings and Specifications are intended to provide the basis for proper completion of the Work suitable for the intended use by the Owner. Anything not expressly set forth but reasonably implied or necessary for proper performance of the project shall be included.
H. Writing Style: Drawings and Specifications are written in the imperative mode. Except where specifically intended otherwise, the subject of all imperative statements is the Contractor. For example, an instruction to “provide” a component of the Work means that, “the Contractor shall furnish and install” that component in its entirety.

I. Welding: Minimize the need for field welds by utilizing shop-welded material wherever possible. If field welding is required, Contractor shall notify the Owner and the local authorities in advance. Contractor shall take all necessary precautions and shall provide a constant fire watch during welding operations. Follow fire watch requirements of the local fire department and pay for all associated costs.

J. Change Orders: Any Work that will result in an increase or decrease to the Contract Sum shall be made by Change Order. If any Work is to result in an increase to the Contract Sum, the Owner and Architect must authorize any additional expenditure for that Work in writing prior to commencement. If any Work is begun or completed prior to an expressly stated determination of additional cost via written authorization, then that portion of the Work will be performed at no additional cost to the Owner.

K. Clean and protect the Work as it proceeds.

L. Employment & Harmony of the Work: The Contractor shall employ personnel who will, at all times, work in harmony with personnel employed by the Owner and other Subcontractors on the Project.
   1. Contracts will be awarded and labor employed without discrimination as to whether the employees of the Owner, the Contractor or any subcontractor are members or non-members of any labor organization.
   2. In the event that the Work is stopped or delayed due to the Contractor not having proper or adequate personnel to perform the Work, the Owner shall have the right to employ such personnel as are needed to complete the unfinished or contested portion of the Work. A Change Order shall deduct the Owner's cost of completing that portion of the Work, including a reasonable allowance for supervision and overhead, from the Contract Sum.

1.05 WORK BY OWNER

A. The Owner will use others for certain aspects of the Work during the Project as noted in the documents, including but not necessarily limited to, the following:
   1. Loose furnishings or similar items.
   2. Miscellaneous items where noted in the documents.

END OF SECTION

SECTION 01 22 00 - UNIT PRICES

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. The Unit Prices for items set forth in the Schedule of Unit Prices shall be used to determine adjustments to the Contract Sum when changes in the Work involving said items are made in accordance with the General Conditions and other Sections of the Contract Documents.

1.02 REQUIREMENTS

A. Unit Price will be paid in accordance with Unit Prices listed by the Contractor on the Schedule of Unit Prices. Quantity of items to be included in the Base Bid shall be determined by the Contractor through examination of the drawings, specifications and site conditions. The Base Bid quantity shall not be listed on the Schedule of Unit Prices.
B. All Unit Prices shall include their pro-rata share of all costs for overhead, profit, bond, materials, equipment, and disposal required to complete the work item.
C. The Contractor shall compute the Unit Prices based on a potential variance of plus or minus fifteen percent (15%) from the quantities determined to be in the Base Bid as indicated on the Drawings, or as otherwise noted herein.
D. The Owner may choose not to approve any or all Unit Prices prior to Award of the Contract if it deems the Unit Price unreasonable. In this case, the Change Order process described in the General Conditions will be used for Work described in the Unit Prices Schedule, if any change to the base contract scope is required.

1.03 APPLICABILITY OF UNIT PRICES

A. The scope of Work in the Base Bid shall be as indicated in the Contract Documents. Unit Price adjustments to the Contract Sum will not be allowed for Work that was specifically described in the Drawings or Specifications, or for Work that could be obviously ascertained from a review of existing conditions and the scope of intended renovations. Refer especially to Section 00 31 19 – EXISTING CONDITIONS.
B. Prior to commencing removal or placement of materials set forth in the Schedule of Unit Prices, the Contractor shall notify the Architect in sufficient time to permit proper measurements to be taken on behalf of the Owner. Only quantities for unit price work that has been approved in advance in writing by the Architect will be considered in the determination of adjustments to the Contract Sum.
C. Performance of Work which is not required under the Contract Documents or which is not authorized by Change Order, whether or not such Work item is set forth hereunder as a Unit Price item, shall not be considered cause for extra payment. The Contractor will be held fully responsible for such unauthorized work, including the performance of all corrective measures required by the Architect.

1.04 UNIT PRICES SCHEDULE

A. The Contractor shall provide a Unit Prices Schedule as attached to this Section and will submit this schedule with the Bid Form. The "Unit Prices Schedule" is not part of the Bid Form but will be submitted with the Bid and will be made part of the Contract Documents if the Owner accepts the Unit Prices as proposed.

UNIT PRICES

Item / Unit of Measurement	Unit Prices	
	ADD	**DEDUCT**
ACM Flooring Materials (per square foot)	$5.00 / SF	($4.50 / SF)
Adjustments to Section 02 82 00 if required		
ACM Rough Plaster (per square foot)	$7.50 / SF	($6.50 / SF)
Adjustments to Section 02 82 00 if required		
ACM Pipe Insulation (per lineal foot)	$25.00 / LF	($20.00 / LF)
Adjustments to Section 02 82 00 if required		
ACM Hard Joint Insulation (each)	$25.00 / EA	($20.00 / EA)
Adjustments to Section 02 82 00 if required		

(Note: ACM = Asbestos Containing Material)

END OF SECTION

SECTION 01 23 00 – ALTERNATES

PART 1 - GENERAL

1.01 SUMMARY

A. General Bidders shall list the complete price for each Alternate on their respective Bid Forms. Include the cost of modifications to other Work and all related costs such as overhead and profit.
B. Owner will select Alternates, if any, sequentially in numerical order prior to award of the Contract for construction.
C. Alternates are briefly described in this Section. Refer to all Contract Documents and site conditions in order to fully determine the requirements for Alternates.
D. Coordinate Alternates with related Work to ensure that Work affected by each Alternate is properly executed.

1.02 SCHEDULE OF ALTERNATES

A. Budget Info included for estimating purposes; remove and reword in final bid documents.
B. ALTERNATE NO. 1 / Audiovisual System in Great Hall:
   1. Budget for Pricing from Consultant = $201,200
   2. Budget as noted is for the AV Subcontractor's work and does not include related work by the General Contractor and Electrical Subcontractor as will be required.
C. ALTERNATE NO. 2 / Great Hall Event Lighting & Controls:
   1. Budget for Pricing = $24,100
   2. Budget as noted is for the cost of fixtures and controls and does not include related work by the General Contractor and Electrical Subcontractor for fixture installation and wiring work as will be required.
D. ALTERNATE NO. 3 / Upgrade Illumination of Exterior Façade:
   1. Budget for Pricing = $11,500
   2. Budget as noted is for the cost of fixturex and does not include related work by the General Contractor and Electrical Subcontractor installation, time clocks and wiring.
E. ALTERNATE NO. 4 / Improve Crescent Street Accessible Parking & Route:
   1. Budget for Pricing: Per CHA Estimator's Determination
   2. This work is shown on the Civil and Landscape Drawings as Alternates 1 + 2, but shall be indentified in the cost estimate collectively as Alternate No. 4 instead.

1.03 ALLOWANCES FOR COST ESTIMATING PURPOSES

A. Allowances provided solely for the purposes of cost estimating since allowances are not allowed in the final bid documents for MGL Chapter 149 projects.
   1. Asbestos Abatement per the HazMat Consultant: $20,000 budget.
   2. Base Bid Lighting Fixtures per Lighting Consultant: $57,500 for the cost of fixtures and lighting controls for Great Hall, and the cost of other fixtures (other than those listed as Alternates) but not including switching, wiring and installation as required for the Work.
   3. Sound Attenuators for HVAC Units: $6,000 for duct attenuators that have not yet been indicated in the mechanical drawings for two ERVs and four fan coil units.

1.04 PRIMARY COST CENTERS FOR ANALYSIS OF ALL BASE BID + ALTERNATE WORK

A. During cost estimating, the following primary categories of work shall be quantified for the purpose of communicating the renovation scope to the Town. Remove this information from the final bid documents since it will not be relevant beyond cost estimating phase.
B. The sum total of these "Cost Centers" shall equal the sum total of the anticipated estimate of construction value for the project, including Alternates, related costs and escalation.

C. If the Cost Estimator has any suggestions about adjustments of these categories, please contact the Architect early in the process to discuss. Similarly, if there are any voids in the descriptions relative to line items in the cost estimate, please request clarification.

D. The Cost Centers as proposed shall be:

1. BUILDING SYSTEM UPGRADES:
   a. Insulate Building Envelope: remove interior plaster & lath finishes from existing walls, ceilings and rafters; salvage interior trim and wainscoting; provide closed cell spray foam insulation in framing cavities including stone walls, rim joists and roof rafters; provide interior drywall finishes to replace the plaster; reinstall and/or replicate supplement trim and wainscoting to restore historic character.
   b. Roof Structure Reinforcement: structurally reinforce roof framing of the 1848 and 1895 portions of the building due to increase in snow loads from insulation.
   c. Replace HVAC Systems: remove oil-fired hot air furnaces, ductwork and fuel oil tank; provide variable refrigerant flow air source heat pump system for heating and cooling; provide energy recovery ventilating units with exterior louvers for fresh air to (and exhaust from) interior spaces; provide sound attenuation systems for Great Hall HVAC; replace exhaust systems for restrooms and provide exhaust to serve custodial closet areas.
   d. Exterior VRF Equipment: provide outdoor equipment on portion of neighbor's land between east wall of Town Hall and outdoor shed; level the area (not yet shown on civil or landscape drawings) and improve site drainage; improve retaining wall adjacent to neighbor's shed; provide 10' foot high double layer sound attenuating wood fence as noted on Drawing A-10.1.
   e. Upgrade Electrical Systems: provide new 3-phase electrical service for HVAC equipment and energy efficient lighting systems; replace all power wiring, low voltage wiring and devices, receptacles, etc.
   f. Window Restoration: Repair all existing windows and provide exterior storms for preservation of the historic sash and reduction of air infiltration.
2. ACCESSIBILITY REQUIREMENTS:
   a. Provide a limited use, limited application elevator to serve the Ground Floor and First Floor levels. Reframe portions of the Ell to accommodate the elevator, including the adjacent stairs. (Note item 4a for further improvements related to this since lowering of the first floor lobby entrance floor and replacement of the exterior ramp with an accessible walkway are restoration items and not essential.)
   b. Reconstruct the Ell stairs to serve three levels due to construction of the elevator, and for compliance with accessibility regulations for stairs and handrails.
   c. Provide an accessible ramp from the Great Hall to the Stage area, including reconstruction of the stage stairs and northern extension of the stage. This work also requires removal of storage closets at each side of the stage, and removal of the furred wall behind the large quilt at the center of the stage.
   d. Replace the vast majority of interior doors, frames and hardware for compliance with accessibility maneuvering clearances and widths. Replace hardware at the few doors that will be retained.
   e. Replace the fire alarm system in its entirety for accessibility compliance.
   f. Replace and expand the restrooms for full compliance with accessibility and for full compliance with current plumbing code relative to building code occupancy.
   g. Reset original granite steps at the front entrance to Great Hall and replace the existing handrails for compliance with current accessibilty and buidling codes. Replace front door hardware with accessible exterior lever and interior exit devices due to the building's occupant load and hardware regulations.
   h. Upgrade (relocate) accessible parking space and improve grading and safety of the accessible route to the accessible entrance (see Alternate No. 4).
3. IMPROVE SUPPORT FACILITIES:
   a. Provide safe and logical entrance from exterior to Ground Floor by removing door entering the stair hall at the south elevation and providing a new door to a new lobby in the Ground Floor directly below the First Floor Ell entrance above.
   b. Provide accessible Kitchenette at the First Floor of the Ell for support of events in the Great Hall.
   c. Provide an audiovisual system in the Great Hall (see Alternate No. 1).

d. Provide an event performance lighting system in Great Hall (see Alternate No. 2).
e. Provide storage room for tables and chairs due to removal of storage cabinets in the Great Hall and to provide location for chair dollies out of the meeting space.
f. Provide two small meeting rooms, one at First Floor and one at Ground Floor.
g. Provide larger office and work area for the Historical Commission in Ground Floor.
h. Provide large storage room in Ground Floor for various purposes.
i. Provide custodial closet with mop sink and other small closet for storage.
j. Reconfigure balcony level seating for avoidance of low beam above, infilling lowest tiered level for safety and providing crowd control ropes to prevent access to the balcony guard.
k. Provide AV equipment control area in balcony for operation by two technicians.

4. SITE & BUILDING RESTORATION & REPAIRS:
   a. Remove contemporary accessible ramp and provide accessible walkway in order to restore the 1895 appearance of the exterior. In addition to the site work, lower the first floor Ell entrance door, creating a split-level first floor lobby in the Ell, and having one additional elevator door landing on the interior. Lower the entry deck outside and extend the column bases at 1895 porch pilasters and column (base extensions shown on A-17 but not yet indicated on structural drawings). Provide guardrails at the Ell entry and portion of accessible walkway.
   b. Remove exterior fire escape exit and stair from the balcony to grade. Infill the exterior wall at former fire escape door.
   c. Remove contemporary accessible ramp at south and east walls of 1895 Ell at street level to ground floor; remove door and infill exterior wall at door leading into building from top of ramp; restore land at neighbor's property and provide 8' high fence to match neighbor's fence at ramp.
   d. Reconstruct the stone retaining wall at the Ground Floor level "alley" that currently leads only to the utility room door. Reconstruction includes replacement and regrading of the "alley" walkway with stairs and railing that leads to the revised lower level entrance area.
   e. Address ongoing water infiltration in the Ground Floor level by:
      i. Removing wood framed flooring and framing in the occupied areas of the Ground Floor and removing the rat slab in the Utilities area.
      ii. Excavating for the provision of under-slab drainage system to address water infiltration along the north wall of the lower level, connecting the drainage to the catch basin to the south on Great Road sidewalk area where shown.
      iii. Providing interior repointing of the north rubble masonry wall of the Ground Floor to address water infiltration through the wall (structural drawings do not yet include this information).
      iv. Providing exterior repointing of the granite base at full perimeter of the building from wood sill to 12" below existing grade; provide crushed stone apron (structural info for repointing of stone masonry not yet noted).
      v. Providing ground floor concrete slabs over vapor retarder over rigid insulation over crushed stone at the occupied areas and the east side of utility area.
      vi. Lowering the slab and finished floor elevation by 6.5" requires replacement of the six free-standing columns below Great Hall, as well as the replacement of columns and bearing wall between the 1848 basement and 1895 addition. Lowering the slab also requires replacement of all floor finishes at this level.
   f. Reconfigure front entrance approach including exterior stairs from Great Road, stone wall revisions, revisions to front walkway, provision of a bench and signage at the former hay scale, and provision of storm water drainage at front lawn.
   g. Provide enhanced exterior lighting by removing a pole-mounted flood light from across Crescent Street and installing appropriate lighting (See Alternate No. 3).
   h. Retain existing embossed metal tin ceilings where present, and remove paint for refinishing. Salvage and relocate tin ceilings from Ground Floor storage and halls (where acoustical ceilings will be provided to conceal ductwork and piping); install salvaged tin and refinish in the lower lobby at the Ground Floor entrance area.

END OF SECTION

SECTION 01 33 00 – SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, DIVISION 00 – PROCUREMENT & CONTRACTING REQUIREMENTS and PART B, DIVISION 01 – GENERAL REQUIREMENTS, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of Work required.

1.02 RELATED DOCUMENTS

A. Consult the individual Sections of the specifications for the specific submittals required under those Sections and for further details and descriptions of the requirements.
B. Nothing in this Section shall be interpreted to conflict, in any way, with the terms of the General Conditions and Supplementary Conditions as they relate to the effect of the Architect's review of submittals. In particular, but without limitation, notwithstanding any of the terms hereof, the Architect's review of all submittals shall be for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

1.03 GENERAL PROCEDURES FOR SUBMITTALS

A. **Timeliness**: The Contractor shall transmit each submittal to the Architect sufficiently in advance of performing related Work or other applicable activities so that the installation is not delayed by processing times, including disapproval and re-submittal (if required), coordination with other submittals, testing, purchasing, fabrication, delivery, and similar sequenced activities. No extension of time will be authorized because of the Contractor's failure to transmit submittals to the Architect in advance of the Work.
B. **Sequence**: The Contractor shall transmit each submittal in a sequence which will not result in the Architect’s approval having to be later modified or rescinded by reason of subsequent submittals which should have been processed earlier or concurrently for coordination.
C. **Contractor's Review and Approval**: Only submittals received from and bearing the stamp of approval of the Contractor will be considered for review by the Architect. The Contractor’s stamp of approval on the submittal shall be the Contractor’s surety to the Architect that the submittal meets the requirements of the contract documents, including its coordination with field conditions, adjacent work and related project components. <u>If a submittal is received by the Architect without the Contractor’s stamp of approval, it will be rejected and returned for revision and resubmittal.</u> Submittals shall be accompanied by a transmittal notice stating name of Project, date of submittal, "To", "From" (Contractor, Subcontractor, Installer, Manufacturer, Supplier), Specification Section, or Drawing No. to which the submittal refers, purpose (first submittal, re-submittal), description, remarks, distribution record, and signature of transmitter.
D. **Architect's Action**: The Architect will review the Contractor's submittals and return them with one of the following actions recorded thereon by appropriate markings:
   1. **Final Unrestricted Release**: Where marked "Approved" the Work covered by the submittal may proceed provided it complies with the requirements of the Contract Documents.

2. **Final-But-Restricted Release**: When marked “Approved as Noted” the Work may proceed provided it complies with the Architect’s notations or corrections on the submittal and complies with the requirements of the Contract Documents. Acceptance of the Work will depend on these compliances.
3. **Returned for Re-submittal**: When marked "Revise and Resubmit" or "Disapproved" the Work covered by the submittal (such as purchasing, fabrication, delivery, or other activity) should not proceed. The submittal should be revised or a new submittal resubmitted without delay, in accordance with the Architect's notations stating the reasons for returning the submittal.

E. **Processing**: All costs for printing, preparing, packaging, submitting, resubmitting, and mailing, or delivering submittals required by this Contract shall be included in the Contract Sum.

1.04 “OR EQUAL”

A. **Definition**: Whenever a specification Section names one or more brands for a given item, and the Contractor wishes to submit, for consideration, another brand, the submission shall be considered an "or equal" or a "material substitution". For the purposes of this Contract, the terms "or equal" and "material substitution" shall be considered synonymous.

B. In no case may an item be furnished on the Work other than the item named or described, unless the Architect shall consider the item equal to the item so named or described.

C. The equality of items offered as "equal" to items named or described shall be proved to the satisfaction of the Architect at the expense of the Contractor submitting the substitution. Refer to Section 01 60 00 “Product Requirements” for a list of criteria for “or equal” items.

D. The Architect may require that full size samples of both the specified and proposed products be submitted for review and evaluation. The Contractor shall bear full cost for providing, delivering, and disposal of all such samples.

E. The Contractor shall assume full responsibility for the performance of any item submitted as an "or equal" and assume the costs of any changes in any Work that may be caused by such substitution.

F. **Or Equal Approval Process**: On the transmittal, or on a separate sheet attached to the submission, the Contractor shall direct attention to any deviations, including minor limitations and variations, from the Contract Documents.
   1. The Contractor shall submit to the Architect for consideration of any “or equal” substitution a written point-by-point comparison containing the name and full particulars of the proposed product and the product named or described in the Contract Documents.
   2. Such submittal shall in no event be made later than 45 calendar days prior to the incorporation of the item into the Work. If the time period specified in the Contract Documents from the Notice to Proceed to Substantial Completion is less than 45 days, then the Architect can waive this requirement.
   3. Upon receipt of a written request for approval of an “or equal” substitution, the Architect shall investigate whether the proposed item shall be considered equal to the item named or described in the Contract Documents. Upon conclusion of the investigation, the Architect shall promptly advise the Contractor that the item is, or is not, considered acceptable as an “or equal” substitution.

1.05 SHOP DRAWINGS

A. Shop Drawings shall be complete, giving all information necessary or requested in the individual Section of the specifications. They shall also show adjoining Work and details of connection thereto.

B. Shop Drawings shall be for whole systems. Partial submissions will not be accepted.

C. The Architect reserves the right to review and approve Shop Drawings only after approval of related product data and samples.

D. Shop Drawings shall be properly identified and contain the name of the project, name of the firm submitting the Shop Drawings, shop drawing number, date of Shop Drawings and revisions, Contractor's stamp of approval, and sufficient spaces near the title block for the Architect's stamp.
E. The Contractor shall submit to the Architect one comprehensive PDF in electronic form of each set of shop drawings. As an alternative, the Contractor may submit six black line prints of each shop drawing. Prints shall be mailed or delivered in roll form. A transmittal notice shall accompany each submittal. Three copies (or one PDF) will be returned to the Contractor. The Architect will retain one copy, distribute one to the Owner and, when applicable, one to the Architect's Consultant.
F. When the submittal is returned by the Architect with the stamp "Revise and Resubmit" or "Disapproved", the Contractor shall correct the original drawing or prepare a new drawing and resubmit a PDF or six prints thereof to the Architect for approval. This procedure shall be repeated until the Architect's approval is obtained.
G. When the submittal is returned by the Architect with the stamp "Approved" or "Approved as Noted", the Contractor shall provide and distribute the PDF or prints in sufficient number for the Contractor's and Subcontractors' use in an expeditious manner.
H. The Contractor shall maintain one full set of approved Shop Drawings at the site. The site documents shall be organized and readily available for review by the Contractor, Subcontractors, Owner and Architect when necessary.

1.06 PRODUCT DATA

A. The Contractor shall submit a comprehensive PDF in electronic form or six copies of Product Data to the Architect. All such data shall be specific and identification of material or equipment submitted shall be clearly marked in ink. Data of a general nature will not be accepted.
B. Product Data shall be accompanied by a transmittal notice. The Contractor's stamp of approval shall appear on the PDF or the printed information itself, in a location that will not impair legibility.
C. Product Data returned by the Architect as "Revise and Re-submit" or "Disapproved" shall be resubmitted as a PDF or in six copies until the Architect's approval is obtained.
D. When the Product Data are acceptable, the Architect will stamp them "Approved" or "Approved as Noted", retain 3 copies, and return 3 copies to the Contractor. The Architect will retain one copy, distribute one to the Owner and, when applicable, one to the Architect's Consultant. The Contractor shall provide approval information to all Subcontractors as applicable.
E. The Contractor shall maintain one full set of approved Product Data at the site. The site documents shall be organized and readily available for review by the Contractor, Subcontractors, Owner and Architect when necessary.

1.07 SAMPLES

A. Unless otherwise specified in the individual Section, the Contractor shall submit two specimens of each sample.
B. Samples shall be of adequate size to permit proper evaluation of materials. Where variations in color or in other characteristics are to be expected, more than two samples may be required in order to show the maximum range of variation. Materials exceeding the variation of approved samples will not be approved on the Work.
C. Samples of items of interior finishes shall be submitted all at once to permit a coordinated selection of colors and finishes.
D. Samples shall be the actual materials with the actual finishes applied. Color brochures or similar submissions will not be considered as acceptable samples.
E. Samples which can be conveniently mailed shall be sent directly to the Architect, accompanied by a transmittal notice. All transmittals shall be stamped with the Contractor's approval stamp of the material submitted.

F. If the Architect rejects a sample, a new sample shall be resubmitted in the manner specified hereinabove. This procedure shall be repeated until the sample is approved by the Architect.
G. Samples will not be returned unless return is requested at the time of submission. The right is reserved to require submission of samples whether or not particular mention is made in the specifications, at no additional cost to the Owner.
H. If a mock-up assembly of various project components are required, that process shall be described in the individual Sections of the specifications pertaining to that Work.

1.08 CONSTRUCTION SCHEDULE

A. The Contractor shall prepare and regularly update a detailed schedule for the Work that indicates the starting and ending dates for each activity. The components of the schedule shall be listed in accordance with CSI format and will include sufficient detail of specific project Work items in order to be a useful planning and tracking document for the Contractor, Owner and Architect.

END OF SECTION

SECTION 01 35 43 - ENVIRONMENTAL PROCEDURES

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 RELATED WORK UNDER OTHER SECTIONS

A. Asbestos Remediation, Section 02 82 00

1.03 HAZARDOUS MATERIALS PROCEDURE

A. Asbestos:

1. Asbestos Materials Exist On-Site: There are accessible and inaccessible asbestos containing materials (ACM) in the existing building. ACM affected by the Renovation and Demolition project are included under this contract. The General Contractor shall formally notify each subcontractor that there are ACM existing in the building. Hidden ACM may only be found during Demolition. Refer to items 2 and 3 below.
2. Unknown and inaccessible ACM: During the Demolition work of the Contract, it is possible that previously unknown asbestos materials may be discovered in currently concealed locations.
3. Notification: If the General Contractor or Sub-Contractors discover or encounter any ACM during the performance of the work, the General Contractor shall immediately:
   a. Stop work, notify the Owner or Architect about the presence of suspect ACM and request instructions for proper action.
   b. Take whatever steps and measures are necessary to reduce, control or eliminate the risk of exposure of workers and the public to the ACM.
   c. Every effort will be made to obtain DEP (12 working day notification period) waivers to remove hidden or unforeseen ACM by the Asbestos Subcontractor. The General Contractor shall allow sufficient time for the removal of the ACM at no additional charges to the Owner for delays if waivers are denied.
4. Responsible Person On-Site: The General Contractor shall designate one of its senior on-site employees to be in charge of coordination between the Architect, the General Contractor, and all subcontractors with respect to hazardous materials issues.
5. Responsibility for Hazardous Material Discovery: It is the sole responsibility of the General Contractor and its Subcontractors to undertake whatever measures, methods of procedures are necessary, required or otherwise appropriate to safeguard the health and safety of all workers and members of the public with respect to identification and discovery of previously unknown hazardous materials during the work of the Project.
6. Indemnification: To the fullest extent permitted by law, the General Contractor shall indemnify and hold harmless the Owner and the Architect and their agents and employees from and against all claims, damages, losses and expenses including, but not limited to, attorneys' fees arising out of or relating to the performance of the Work, including the discovery or identification of any hazardous materials, provided that any such claim, damage, loss or expense if attributable to bodily injury, sickness, disease or death, or to damage to or destruction of tangible property (other than the Work itself) including the loss of use resulting therefrom; and is caused in whole or in part by any negligent act or omission of the General Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.

B. Lead:

1. The General Contractor shall be made aware that Lead Based Paint exists on painted surfaces throughout the building.
2. It is the General Contractor responsibility to either test painted surfaces or assume that all existing painted surfaces are coated with Lead Paint. All costs for testing shall be the responsibility of the General Contractor at no additional cost to the Owner.
3. All the work of this Contract shall conform to the standard set by all applicable Federal, State and Local laws, regulations, ordinance and guidelines in such from in which they exist at the time of the work on the Contract and as may be required by subsequent regulations.
4. The General Contractor is solely responsible for means and methods, and techniques used for demolition and lead control. The General Contractor shall collect, and control lead contaminated debris and to properly remove and dispose of lead contaminated soil around the building due to demolition activities.
5. The General Contractor shall at his own cost and expense comply with all laws, ordinance, rules and regulations of Federal, State, Regional and Local authorities during demolition, prepping, sanding, cutting, burning, scraping, painting over, grinding and regarding handling, storing and disposing of lead and lead contaminated waste material.
6. The General Contractor shall submit to the Architect prior to commencing of work the following:
   a. Written respiratory and notification program
   b. Written lead compliance program in accordance with OSHA regulations including:
      1. Training requirement certifications.
      2. Supervisor qualifications.
      3. Written compliance program specific to this project
      4. Respirators fit test records.
      5. Medical surveillance certificates.
7. The EPA and the DEP require demolition debris with lead to be tested in accordance with the Toxicity Characteristic Leaching Procedure (TCLP) to determine the potential for significant amounts of lead to leach out of the waste. If the results are below the DEP standard (5.0 ppm), the waste may be disposed of in a conventional landfill for demolition debris. If, however, the TCLP results are above the DEP standard, the waste must be disposed of in a DEP approved, hazardous waste landfill. The General Contractor shall at its own cost and expense perform all required testing of waste by the TCLP. The General Contractor must submit to the Owner copy of tests performed and all waste shipment records prior to disposing of debris. The Owner reserves the right to have own TCLP samples collected to verify results. All disposal costs shall be the General Contractor's responsibility.
8. The following references are cited as current applicable publications. This project is subject to compliance with all regulations including but not limited to:
   a. Commonwealth of Massachusetts, Department of Labor and Work Force Development 454 CMR 11.00, Structural Painting Safety Code, as currently amended.
   b. Commonwealth of Massachusetts, Department of Environmental Protection, and Hazardous Materials Regulations at 310 CMR 30.00 as currently amended.
   c. U. S. Department of Labor, Occupational Safety and Health Administration Title 29 CFR 1910.1025 and 29 CFR Part 1926.62.
   d. U. S Department of Environmental Protection, Resources Conservation and Recovery Act.
   e. Commonwealth of Massachusetts, Department of Labor and Work Force Development 454 CMR 22.00.
   f. Commonwealth of Massachusetts, Department of Environmental Protection, 310 CMR 6.0-8.0.
   g. Commonwealth of Massachusetts, Department of Environmental Protection ABC rubble rules.

9. All above regulations are applicable to this project. Where there is a conflict between this section and the applicable regulations, the more stringent requirement shall prevail.

C. Other Hazardous Materials:
   1. The General Contractor shall be made aware that other hazardous materials are to be found inside/outside the building.
   2. The General Contractor shall be responsible for quantifying, removal and proper disposal of all remaining hazardous materials, including but not limited to batteries and related electrolytic material, PCB's, mercury and Freon inside air conditioners, switches, exit signs, thermostats and other items.

D. PCB's:
   1. All Contractors shall be made aware that building materials (Material) including but not limited to painted surfaces, caulking, glue, coatings, and other building materials are likely to contain >1 ppm of Polychlorinated Biphenyls PCB's.
   2. No testing was performed, and no testing will be permitted.
   3. All of the work of this Contract shall conform to the standard set by all applicable Federal, State and Local laws, regulations, ordinance, and guidelines.
   4. Contractors are solely responsible for means and methods, and techniques used for demolition and control.
   5. Contractors shall at his own cost and expense comply with all laws, ordinance, rules and regulations of Federal, State, Regional and Local authorities during prepping, sanding, cutting, burning, scraping, painting over, grinding and regarding handling, storing and disposing of contaminated waste material and during demolition of the building.

PART 2 – PRODUCTS Not Used

PART 3 – EXECUTION Not Used

END OF SECTION

SECTION 01 45 23 - TESTING AND INSPECTING SERVICES

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to coordinate the Work of this Section, including but not limited to the following:
   1. Concrete testing for cast-in-place concrete.
   2. Soil testing as needed, as determined by the Contractor's evaluation of soils after excavations.
   3. Structural Steel testing, including review of welds, steel framing for structural work, steel reinforcing for concrete, steel elevator pit ladder, metal guardrails, metal handrails, and miscellaneous structural steel metal fabrications.
   4. Wood Construction testing, including review of materials, connections, hangers and fastening methods.
   5. The Contractor shall keep records of all inspections and shall furnish inspection reports to the Building Official and the Registered Design Professional in Responsible Charge.
   6. Tests, inspections and approvals of portions of the Work required by the Contract Documents or by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity retained by the Owner, or with the appropriate public authority. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures.
   7. The Owner shall bear all related costs of tests, inspections and approvals.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 03 30 00 Cast-in-Place Concrete.
   2. Section 05 12 00 Structural Steel Framing.
   3. Section 06 10 00 Rough Carpentry.
   4. Section 31 20 00 Earthwork.

1.04 REFERENCES

A. Testing is to be perfomed in accordance with the requirements of the Massachusetts State Building Code, 780 CMR.

PART 2 - MATERIALS (N/A)

PART 3 - EXECUTION

3.01 CONCRETE TESTING

A. General
   1. Mix Design: Submit proposed mix design to inspection and testing firm for review prior to commencement of work. Review concrete batch tickets and verify compliance with approved mix design. Verify that water added at the site does not exceed that allowed by the mix design. Refer to ACI 318: 3.5, 7.1-7.7 & IBC 1913.4. [Testing Agency Qualifications: ACI-CCI.]
   2. Material Certification: Review mill certificates for conformance with project requirements. [Testing Agency Qualifications: ACI-CCI.]
   3. Reinforcement Installation: Prior to concrete placement, inspect size, spacing, cover, positioning and grade of reinforcing steel. Verify that reinforcing bars are free of form oil or other deleterious materials. Inspect bar laps and mechanical splices. Verify that bars are adequately tied and supported on chairs or bolsters Refer to ACI 318: 3.5, 7.1-7.7 & IBC 1913.4. [Testing Agency Qualifications: ACI-RCSI.]
   4. Anchor Rods: Inspect size, positioning and embedment of anchor rods. Inspect concrete placement and consolidation around anchors. Refer to ACI 318: 8.1.3, 21.2.8, 3.8.6, 8.1.3, 21.2.8 & IBC 1911.5,1912.1. [Testing Agency Qualifications: ACI-CCI.]
   5. Concrete Placement: Inspect placement of concrete for each pour. Verify that concrete conveyance and depositing avoids segregation or contamination. Verify that concrete is properly consolidated. Refer to ACI 318: 5.9, 5.10 & IBC 1913.6, 1913.7, 1913.8. [Testing Agency Qualifications: ACI-CCI; ACI-RCSI.]
   6. Sampling and Testing of Concrete: Test concrete compressive strength (ASTM C31 & C39), slump (ASTM C143), air-content (ASTM C231 or C173) and temperature (ASTM C1064). Refer to ASTM C 172, C 31, ACI 318: 5.6, 5.8 & IBC 1913.10. [Testing Agency Qualifications: ACI-CFTT; ACI-STT.]
   7. Curing and Protection: Inspect curing, cold weather protection and hot weather protection procedures. Refer to ACI 318: 5.11-5.13 & IBC 1913.9. [Testing Agency Qualifications: ACI-CCI; ACI-RCSI.]
   8. Other: Inspect formwork for shape, location and dimensions of the concrete member being formed. Refer to ACI 318: 6.1.1. [Testing Agency Qualifications: ACI-CCI.]
B. Testing
   1. Frequency: minimum 4 test cylinders per each pour, or 50 cu yds, whichever is more frequent.
   2. Cement and Aggregates: Tests of cement and aggregates may be performed to ensure conformance with specified requirements.
   3. Test Cylinders: Four concrete test cylinders will be taken per each pour, or 50 cu. yds., whichever is more frequent.
   4. One additional test cylinder will be taken during cold weather concreting and cured on the job site under the same conditions as the concrete it represents.
   5. Test for concrete compressive strength, slump, air-content and temperature.
C. Delivery Tickets:
   1. Batch plant shall certify by signing, initialing, or stamping delivery slips that ingredients in truck-load mixes conform to proportions of aggregate weight, cement factor, and water-cement ratio as specified.
   2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered is incorrect.

3. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor's expense. Any rejected concrete that is placed will be subject to removal.

D. Laboratory Tests: Furnish certified compression test reports to the Architect. Each test report shall indicate the following information:
   1. Cylinder identification number and date cast.
   2. Specific location at which test samples were taken.
   3. Type of concrete, slump, and percent air.
   4. Compressive strength of concrete in psi.
   5. Weight of lightweight structural concrete in pounds per cubic foot.
   6. Weather conditions during placing.
   7. Temperature of concrete in each test cylinder when test cylinder was molded.
   8. Maximum and minimum ambient temperature during placing.
   9. Ambient temperature when concrete sample in test cylinder was taken.
   10. Date delivered to laboratory and date tested.

3.02 SOIL TESTING

A. Shallow Foundations:
   1. Inspect soils below footings for adequate bearing capacity. Verify excavations are to proper depth.
   2. Inspect removal of unsuitable material and preparation of subgrade prior to placement of controlled fill.
   3. All soil supporting new footings to be inspected prior to placing forms.

B. Controlled Structural Fill:
   1. Perform sieve tests (ASTM D422 & D1140) and modified Proctor tests (ASTM D1557) of each source of fill material.
   2. Inspect placement, lift thickness and compaction of controlled fill.
   3. Test density of each lift of fill by nuclear methods (ASTM D2922).
   4. Verify extent and slope of fill placement.

C. Testing Agency Qualifications: soil testing including placement monitoring, compaction testing and lab analysis.

3.03 STRUCTURAL STEEL TESTING

A. Fabricator Certification / Quality Control Procedures: Prior to fabrication : Review shop fabrication and quality control procedures. OR Confirm that the fabricator is AISC certified. [Testing Agency Qualifications: AWS/AISC-SSI.]

B. Material Certification: Review certified mill test reports and identification markings on wide-flange shapes, high-strength bolts, nuts and welding electrodes. [Testing Agency Qualifications: AWS/AISC-SSI.]

C. Bolting: Inspect installation and tightening of high-strength bolts. Verify that splines have separated from tension control bolts. Verify proper tightening sequence. Continuous inspection of bolts in slip-critical connections. [Testing Agency Qualifications: AWS/AISC-SSI.]

D. Welding: Continuous, except periodic for single-pass welds < 5/16": Visually inspect all field welds and 25% of shop welds, except all full penetration welds to be 100% inspected. Inspect pre-heat, post-heat and surface preparation between passes. Verify size and length of fillet welds. Ultrasonic testing of all full-penetration welds. [Testing Agency Qualifications: AWS/CWI; ASNT.]

E. Structural Details: Inspect steel frame for compliance with structural drawings, including bracing, member configuration and connection details. [Testing Agency Qualifications: PE/SE.]

F. Other: Inspection of steel frame joint details for compliance: Details such as bracing and stiffening; Member locations; Application of joint details at each connection. [Testing Agency Qualifications: PE/SE.]

3.04 WOOD CONSTRUCTION TESTING

A. Fabricator Certification / Quality Control Procedures: Inspect shop fabrication and quality control procedures for wood truss plant. [Testing Agency Qualifications: Fabricator exempt.]
B. Material Grading: General conformance with construction documents. [Testing Agency Qualifications: PE/SE.]
C. Connections: General conformance with construction documents. [Testing Agency Qualifications: PE/SE.]
D. Framing and Details: General conformance with construction documents. [Testing Agency Qualifications: PE/SE.]
E. Diaphragms and Shearwalls: Inspect size, configuration, blocking and fastening of shearwalls and diaphragms. Verify panel grade and thickness. [Testing Agency Qualifications: PE/SE.]

3.05 OTHER TESTING

A. Prior to placement of rigid insulation, vapor retarder, reinforcing bars or other components, test the compaction level and bearing capacity of the soils below footings, slabs and column supports for conformance with the Contract Documents.
B. Review structural steel framing and representative welds after installation and prior to placement of concrete reinforcing or wood framing that may conceal weld locations.

3.06 QUALIFICATIONS OF INSPECTORS AND TESTING TECHNICIANS

A. The qualifications of all personnel performing Special Inspection and testing activities are subject to the approval of the Building Official. The credentials of all Inspectors and testing technicians shall be provided if requested.
B. Key for Minimum Qualifications of Inspection Agents: When the Registered Design Professional in Responsible Charge deems it appropriate that the individual performing a stipulated test or inspection have a specific certification or license as indicated below, such designation shall appear on a Testing Schedule for each required test. The Testing Schedule shall be prepared by the Registered Design Professional in Responsible Charge.

3.07 CERTIFICATIONS AND LICENSES

PE/SE	Structural Engineer – a licensed SE or PE specializing in the design of building structures
PE/GE	Geotechnical Engineer – a licensed PE specializing in soil mechanics and foundations
EIT	Engineer-In-Training – a graduate engineer who has passed the Fundamentals of Engineering examination

American Concrete Institute (ACI) Certification

ACI-CFTT	Concrete Field Testing Technician – Grade 1
ACI-CCI	Concrete Construction Inspector
ACI-LTT	Laboratory Testing Technician – Grade 1&2
ACI-STT	Strength Testing Technician

American Welding Society (AWS) Certification

AWS-CWI	Certified Welding Inspector
AWS/AISC-SSI	Certified Structural Steel Inspector

American Society of Non-Destructive Testing (ASNT) Certification

ASNT	Non-Destructive Testing Technician – Level II or III.

International Code Council (ICC) Certification

ICC-SWSI	Structural Steel and Welding Special Inspector
ICC-RCSI	Reinforced Concrete Special Inspector

National Institute for Certification in Engineering Technologies (NICET)

NICET-CT	Concrete Technician – Levels I, II, III & IV
NICET-ST	Soils Technician - Levels I, II, III & IV
NICET-GET	Geotechnical Engineering Technician - Levels I, II, III & IV

Other	**Soils Testing Agency approved to perform ASTM soils tests.**

END OF SECTION

SECTION 01 50 00 - TEMPORARY FACILITIES & CONTROLS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. The Contractor shall be responsible for providing and maintaining all temporary facilities until Substantial Completion. Removal of such prior to Substantial Completion must be with the concurrence of the Architect. The Contractor bears full responsibility for replacing any temporary facility that is removed prior to Substantial Completion.
B. Removal of all temporary facilities shall be a condition precedent to Substantial Completion unless directed otherwise by the Architect or specifically noted in the specifications.
C. The Contractor must comply with safety laws and regulations of the Commonwealth of Massachusetts, the Federal Government and local governmentakl agencies applicable to all Work under this Contract.

1.02 TEMPORARY FACILITIES AND CONTROLS INCLUDED

A. FIELD OFFICES AND FACILITIES
   1. The Contractor shall provide a suitable office at the site for use by the Contractor's personnel. The office shall be set in a location approved by the Owner within the existing building unless the Contractor prefers an outdoor temporary office trailer at its option. The office shall be maintained by the Contractor in a clean and orderly condition. The office, if within the existing building, shall be relocated as needed in order to accommodate construction sequence requirements.
B. TEMPORARY TELECOMMUNICATIONS
   1. The Contractor shall provide telephone service and telecommunications equipment as needed for the use of the Contractor's authorized personnel and Subcontractors.
   2. The Contractor shall pay for the installation and removal of temporary telephones and data equipment, for temporary telephone lines and data cabling into and within the site office, and for all calls and charges in connection therewith.
C. TEMPORARY TOILETS
   1. The Contractor shall provide a suitable quantity of outdoor portable toilets in locations mutually acceptable to the Owner and Contractor for the duration of the construction time period.
   2. Portable toilets shall be emptied on a regular basis and shall be kept clean.
D. TEMPORARY BARRICADES
   1. The Contractor shall be responsible for providing and maintaining temporary barricades around the construction areas as may be necessary to assure the safety of all persons authorized or unauthorized. Such protective measures shall be located and constructed as required by local, state, and federal ordinances, laws, codes, or regulations.
   2. The Contractor shall provide dust and sound partititons or curtains in areas where demolition Work is being performed in order to reduce the possibility of dust and noise migration to adjacent areas.
E. TEMPORARY FENCING AT PERIMETER OF WORK AREA
   1. Provide a 6-foot high commercial grade chain link fence around the construction site. Equip with vehicular and pedestrian gates and locks at required locations. Relocate fences and gates as required due to construction phasing.
   2. Provide gates with cross bracing, and hung on heavy strap hinges with post and hook for double gates. Provide heavy hasps and padlocks. Provide a set of

keys to Owner's Project Manager and the local Fire Department to facilitate emergency access to the construction area if necessary.

3. Chain link fabric shall be made of coated-steel, 9 gage (0.148 inch) core wire woven in 2-inch uniform mesh, height (roll width) to suit fence height with bottom selvage knuckled, top selvage twisted, with woven fabric having minimum breaking strength of 1290 pounds.
4. Posts and rails shall be sized as required, Type 1 seamless steel pipe, ASTM A-120, standard weight schedule 40, hydrostatic testing waived.
5. Gate posts shall be standard weight pipe 2-7/8 inches OD nominal weight, 5.79 pounds per foot.
6. Gate frames shall be 2 inches OD standard weight pipe, 2.73 pounds per foot with heavy malleable iron or pressed steel corner fittings securely riveted. Fabric to match the fence and installed in the frame by means of tension bars and hook bolts. Each frame to be equipped with 3/8-inch diameter adjustable truss rods.
7. Bottom hinges shall be ball and socket type designed to carry the weight of the gate on the post footing. Upper hinge shall be wrap-around adjustable type. All gates to be equipped for padlocking and with semi-automatic outer catches to secure gates in opened position.
8. Fittings shall be pressed steel or malleable iron, hot-dipped galvanized conforming to the requirements of ASTM A153. Tie wires shall be minimum nine-gage galvanized wire and attachment bolts shall be galvanized.
9. Post settings shall be driven into ground where feasible and appropriate based on existing site conditions and construction limits. Temporary bases may be used where fencing is scheduled for relocation due to construction sequencing.
10. Provide green or black mesh debris netting at temporary fencing. Securely fasten and maintain a level and plumb appearance at all times.

F. TEMPORARY STRUCTURES AND MATERIAL HANDLING

1. Materials shall be handled, stored, installed, cleaned, and protected in accordance with the best practice in the industry and, except where otherwise specified in the Contract Documents, in accordance with manufacturer's specifications and directions.
2. The Contractor must obtain the permission of the Owner for the location of any temporary storage facilities on site. The Contractor assumes full responsibility for stored items. Evenly distribute the weight of items stored within the building in order to avoid overloading the capacity of the existing structure.
3. Protect existing site features from damage and settlement resulting from any items stored outside the building.

G. TEMPORARY STAGING, STAIRS, CHUTES

1. The Contractor shall furnish, install, maintain in safe condition, and remove all scaffolds, staging, and planking over 8 ft. in height, as required for the use of all trades for proper execution of the Work. Provide fire-retardant debris netting that is neatly and securely attached to staging.
2. The Contractor shall furnish, install, maintain in safe condition, and remove any and all temporary ramps, stairs, ladders, and similar items as required for the use of all trades for the proper execution of the Work.
3. The Contractor shall furnish, install, maintain, and remove covered dumpsters and rubbish containers as may be necessary for the project. Such shall be in locations approved by the Owner and local authorities and permit disposal of rubbish directly into trucks or disposal units provided by the Contractor. The Contractor shall be responsible for the procurement of or temporary restricted access to any sidewalk, street and parking space. The Contractor shall pay for all police details and any other usage permits and associated fees.
4. Debris shall not be allowed to fall freely from the roof and upper levels of the building. Materials shall not be dropped from windows.

H. HOISTING FACILITIES
   1. Except as otherwise specified, the Contractor shall provide, operate, and remove material hoists, cranes, and other hoisting as required for the performance of the Work by all trades. All hoisting services shall be without cost to Subcontractors.
I. TEMPORARY WATER
   1. The Contractor may make use of the available water supply at the site for construction purposes. The Contractor shall not abuse this privilege.
   2. The Owner shall pay the cost of water and sewer expense incurred at the building throughout the construction period.
   3. The Contractor shall provide all necessary piping and hoses to utilize the available sources of water and to make temporary connections to drains.
   4. The Contractor shall provide an adequate supply of cool drinking water with individual drinking cups for all construction personnel on the job.
   5. Note that a public water supply line passes through this building to serve other structures and that water supply shall remain available for continuous use.
J. TEMPORARY ELECTRICITY
   1. The Contractor may make use of the electricity available at the site for construction purposes. The Contractor shall not abuse this privilege.
   2. The Owner shall pay the cost of all metered electricity usage at the building throughout the construction period.
   3. The Contractor shall take reasonable care to not overload fuses in the building. If fuses or circuits are blown by the Contractor, he shall immediately correct the situation and revise his operations to prevent such occurrences.
   4. Temporary Electrical Work shall be performed in accordance with applicable codes and safety guidelines at all times.
   5. The Electrical subcontractor shall provide temporary work lighting of sufficient levels in relevant areas of the Work.
K. TEMPORARY WEATHER PROTECTION
   1. The Contractor shall provide temporary protection in the areas of Work as applicable to protect the existing building from weather damage throughout the construction period.
   2. Protect the existing building from water infiltration during demolition and construction activities related to the building envelope, including the provision of securely fastened temporary tarps, temporary sheathing and watertight temporary drainage as needed.
   3. Should high wind warnings be issued by the U.S. Weather Bureau, the Contractor shall take every precaution to minimize danger to persons, to the Work, and to adjacent properties.
   4. The Contractor shall bear the responsibility of snow and ice removal in the area of Work in order to provide full access to the site and all Work in progress. This shall include all snow and ice removal within the confines of temporary fencing and barricades, and removal as needed in the immediate vicinity of temporary facilities when necessary to gain access to the work area.
L. TEMPORARY HEATING
   1. The Contractor shall provide temporary enclosures and heat to permit Work to be carried on during the months of October through April to the extent required based on outdoor temperatures and conditions in relation to the type of Work being performed. The Contractor shall include the costs of any portable fuel or site generated electricity required for temporary heating and enclosures in the Contract Sum until Substantial Completion. When temporary heating uses the resources of the existing building's fuel supply (active fuel oil; abandoned natural gas) or electricity, the cost of those utilities shall be borne directly by the Owner.
   2. Temporary enclosures and heat shall provide adequate working areas to permit the continuous progress of all Work necessary to maintain an orderly and efficient sequence of construction operations. The Contractor shall furnish and install temporary enclosures and heat and shall be responsible for all costs to maintain a minimum of 40 degrees F at the working surface. This provision does

not supersede any specific requirements for methods of construction, application limits for materials, curing of materials, or the applicable conditions set forth in the Contract Documents with added regard to performance obligations of the Contractor.

3. The Contractor shall assume the entire responsibility for temporary enclosures and heat during construction until Substantial Completion, and shall be liable for any damage to any Work caused by failure to supply proper enclosures, adequate temperature levels and proper ventilation.
4. The Contractor shall provide a sufficient number of thermostats to monitor air and surface temperatures in the areas of Work.
5. Any constructed element of the building or Work provided under this contract that is damaged by frost shall be removed and replaced by the Contractor at its own expense.
6. The Contractor shall do no Work under any conditions deemed unsuitable by the Contractor for the execution of the Work. This provision shall not constitute any waiver, release, or lessening of the Contractor's obligation to bring the Work to Substantial Completion within the period of time set forth in the Contract Documents.

M. PROJECT SIGNAGE

1. The Contractor will be allowed to place a temporary sign to identify the Project, Contractor, Subcontractors, Owner and Architect if desired. The size and location of the sign must be reviewed and approved in advance by the Owner and Architect. This signage is not required by the Town.
2. The Contractor shall be solely responsible for receiving local approval for compliance with zoning regulations. The Contractor shall be responsible for securing and paying for any required signage permits. Note that a temporary sign must comply with Section 6.3 of the Stow Zoning Bylaw for compliance in a residential zoning district adjacent to a state highway.
3. The Contractor shall be responsible for providing signs necessary for warning the public about the construction zone and prohibiting entrance therein, including any temporary parking or vehicular access restrictions due to work in selected areas.

N. PARKING

1. The Contractor will be responsible for legally parking in the vicinity of the site.
2. The Contractor shall be responsible for obtaining approvals and permits for their use of the street and sidewalk and for paying all associated fees as necessary.

O. PROTECTION OF PERSONS & PROPERTIES

1. The existing building will not be occupied during construction.
2. Any damage to the existing building, any adjacent buildings, sidewalks (brick, granite, concrete and other), roads (public and private), bituminous concrete areas, fences, lawn areas, trees, shrubbery, poles, underground utilities, curbs, etc. shall be made good by and at the Contractor's own expense to the satisfaction of the Owner, Architect, abutters and authorities having jurisdiction.
3. In the event that the Contractor damages any property of the Owner, abutters or the like, he shall notify the Owner immediately in writing.
4. The Contractor shall, at no expense to the Owner, patch, repair and/or replace all adjacent materials and surfaces that may become damaged. All repair and replacement Work shall match the existing in kind and in appearance.

P. TEMPORARY PROTECTION

1. The Contractor shall:
   a. Protect the existing building and materials at all times from damage of any origin. Provide all coverings and other materials and equipment as required by job conditions to accomplish this requirement.
   b. Protect other areas, furniture, and private property of the Owner and building occupants. Any areas damaged by the Contractor shall be restored to the original condition or compensated at the Contractor's expense.
2. After the installation of the Work by any Subcontractor is completed, the Contractor shall, unless directed otherwise by the Work of other Sections, be

responsible for its protection and for repairing, replacing, or cleaning any such Work which has been damaged by other trades or by any other cause, so that all Work is in first class condition at the time of Substantial Completion.

Q. TEMPORARY ACCESS PROVISIONS
   1. The Contractor shall, at all times, leave an unobstructed way along walks, hallways, stairways and roadways, and shall maintain barriers and lights for the protection of all persons and property in all locations where materials are stored or Work is in progress.

R. SECURITY
   1. The Contractor shall be responsible for providing all security precautions necessary to protect the Contractor's and Owner's interests.

S. NOISE AND DUST CONTROL
   1. The Contractor shall take special measures to protect the building, occupants, neighbors, and general public from noise, dust, and other disturbances by:
      a. Keeping common pedestrian and vehicular circulation areas clean and unobstructed.
      b. Insulating Work areas from any immediately adjacent finished portions of the building if applicable based on the sequence of the Work.
      c. Sealing dust and fumes from contaminating finished spaces and, where applicable, from adjacent public and private spaces.
      d. Providing temporary acoustical barriers as needed for limiting sound levels to within the range of allowable maximum levels.
      e. Cooperating with local neighborhood and municipal requirements and regulations in effect regarding noise pollution during construction and respecting the environmental constraints of working at the project site.

T. FIRE PROTECTION
   1. The Contractor shall take necessary precautions to insure against fire during construction. The Contractor shall be responsible to insure that the area within contract limits is kept orderly and clean and that combustible rubbish and construction debris is promptly removed from the site.
   2. Installation of equipment suitable for fire protection shall be done as soon as possible after commencement of the Work.
   3. The Contractor shall maintain and protect the Owner’s existing monitored fire detection system and shall promptly perform any repairs to the system if damaged or disrupted during the Work.
   4. The Contractor shall promptly comply with any and all requirements or directives provided by the local fire department regarding precautions, cleaning and fire safety.
   5. Provide a constant fire watch for any on-site welding activities, complying with the full duration of the watch as stipulated by the local fire department.
   6. Smoking in and around the building and project site is prohibited.

U. FALSE FIRE AND SECURITY ALARMS
   1. The Contractor shall bear the costs incurred by the Owner of any false fire or security alarms if such false alarms are caused by the Work or presence of his own personnel, his subcontractors, vendors, material suppliers or any of the Contractor’s visitors to the Work site.

END OF SECTION

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to Division 00 and Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 MANUFACTURERS

A. Provide products from one manufacturer for each type or kind as applicable. Provide secondary materials as recommended by manufacturers of primary materials.

1.03 SUBSTITUTIONS

A. Provide products selected or approved equal. Products submitted for substitution shall be submitted with acceptable documentation, including costs of substitution and related work.
B. Substitute products must match or exceed specified products in every respect, including but not limited:
   1. Quality of workmanship and durability of materials.
   2. Duration of service life and warranty terms.
   3. Color choices and aesthetic attributes.
   4. Acoustical qualities and measurable test data demonstrating performance.
   5. Energy performance equivalent to or better than specified product.
   6. Suitability of the product for the intended application.
C. Conditions for substitution include:
   1. An “or approved equal” phrase in the specifications.
   2. Specified material cannot be coordinated with other work.
   3. Specified material is not acceptable to authorities having jurisdiction.
   4. Substantial advantage is offered Owner in terms of cost savings, time, or other valuable consideration.
D. Substitutions shall be submitted prior to the agreement of the Owner and Contractor establishing the final Contract Sum unless otherwise acceptable. Refer to the General and Supplementary Conditions for substitutions. Approval of shop drawings, product data, or samples does not constitute approval of substitution unless clearly presented as a substitution at the time of submittal.

END OF SECTION

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Provide cutting and patching work to properly complete the Work of the Project, complying with requirements for:
   1. Demolition and construction Work.
   2. Visual requirements, including detailing and tolerances.
   3. Operational and safety limitations, including fire-resistance ratings.
   4. Inspection, preparation, and performance.

B. Do not cut and patch in a manner that would result in a failure of the Work to perform as intended, decreased energy performance, increased maintenance, decreased operational life, or decreased safety.

C. Cutting and patching shall be performed by the General Contractor for all trades unless noted otherwise in other Sections. Coring, unless noted otherwise in specific instances, shall be performed by the individual trades with coordination by the G.C.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Match existing materials for cutting and patching work with new materials conforming to project requirements. Provide materials which are compatible to existing adjacent construction and which match existing textures, colors, tooling and composition.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Inspect Project conditions prior to Work to identify scope and type of Work required. Protect adjacent Work. Notify Owner of Work requiring interruption to building services or Owner's operations.

B. Perform Work with workmen skilled in the trades involved. Prepare sample area of each type of Work for approval.

C. Cutting: Use cutting tools, not chopping tools. Make neat holes. Minimize damage to adjacent Work. Check for concealed utilities and structure before cutting. Core drill masonry and concrete surfaces where piping requires passage.

D. Patching: Make patches, seams, and joints durable and inconspicuous. Comply with tolerances for new Work. Infill holes where existing devices are removed from surfaces and where piping, conduits, ductwork and the like penetrate walls and floors. Provide fire stopping at penetrations in surfaces which are fire rated. Seal all penetrations in exterior surfaces so that they are fully weather tight.

E. Protect all surrounding areas from damage from water, dust and debris as a result of cutting and patching Work. Clean all areas affected by operations.

END OF SECTION

SECTION 01 74 00 – CLEANING AND WASTE MANAGEMENT

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Consult the individual Sections of the specifications for cleaning of Work installed under those Sections.

1.02 WORK INCLUDED

A. CLEANING DURING CONSTRUCTION
   1. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
      a. Do not burn or bury rubbish and waste materials on the site.
      b. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
      c. Do not dispose of wastes into streams or waterways.
   2. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
   3. Do not allow materials and rubbish to drop free or be thrown from upper floors or the roof, but remove by use of a material hoist, rubbish chutes or by removal to a lower level within the building.
   4. Maintain the site free from accumulations of waste, debris, and rubbish. Provide cleaning throughout the day as needed.
   5. Provide on-site containers for collection of waste materials and rubbish.
   6. At the end of each day, remove from site and legally dispose of all waste materials and rubbish generated as part of the Work under this contract.
   7. Vacuum clean interior building areas that may be affected by the Work on an as-needed basis until Substantial Completion.
   8. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.
   9. Disposal of materials shall be in compliance with all applicable laws, ordinances, codes, and by-laws.
   10. Recycle construction demolition and debris in all categories mandated by current regulations of the Massachusetts Department of Environmental Protection.
   11. Recycle construction demolition and debris where specified in other Sections of the Project Manual.

B. FINAL CLEANING
   1. Prior to submitting a request to the Architect to certify Substantial Completion of the Work, the Contractor shall inspect all interior and exterior spaces and verify that all waste materials, rubbish, tools, equipment, machinery, and surplus materials have been removed, and that all sight-exposed surfaces are clean. Leave the Project clean and ready for occupancy.
   2. Unless otherwise specified under other Sections of the Specifications, the Contractor shall perform final cleaning operations as herein specified prior to final inspection.
   3. Cleaning shall include all surfaces, interior and exterior, which the Contractor has had access to, whether new or existing. Cleaning shall also extend to all areas of dust migration as a result of the Work of this contract, including cleaning of adjacent spaces, concealed areas and areas on other floor levels of the building as deemed necessary.
   4. Employ experienced workmen or professional cleaners for final cleaning.
   5. Use only cleaning materials recommended by the manufacturer of the surface to be cleaned.
   6. Use cleaning materials which will not create a hazard to health or property and which will not damage surfaces.

7. Any broken or defective glass caused by the Contractor's Work shall be replaced with matching glass at the expense of the Contractor.
8. Remove grease, mastic, adhesive, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior surfaces. This includes cleaning of the Work of all finishing trades where needed, whether or not cleaning by such trades is included in their respective specifications.
9. Clean and polish interior and exterior surface of all windows and doors throughout the building. This cleaning shall be completed by qualified, professional window cleaners hired by and at the expense of the Contractor just prior to acceptance of the Work.
10. Repair, patch, and touch up marred surfaces to the specified finish of materials, to match adjacent surfaces.
11. Leave all architectural metals, hardware, and fixtures in undamaged, polished conditions.
12. When cleaning items with manufacturer's finish or items previously finished by a Subcontractor, care shall be taken to not damage such manufacturer's or Subcontractor's finish. In cleaning glass and finish surfaces, care shall be taken to not use detergents or other cleaning agents which may stain adjoining finish surfaces. Any damage to finishes caused by cleaning operations shall be repaired at the Contractor's expense.
13. Owner's responsibility for cleaning commences at Substantial Completion, except in areas further disrupted by the Work of this Contract or not yet occupiable and useable by the Owner.

END OF SECTION

SECTION 01 77 00 - CLOSE-OUT PROCEDURES

PART 1 - GENERAL

1.01 SUBSTANTIAL COMPLETION

A. Prior to requesting Substantial Completion, the Contractor shall make a thorough inspection of the Work. During this inspection, the Contractor shall prepare a comprehensive list of all items remaining to be completed or corrected. This list shall include all remaining Contractor and Subcontractor items to be provided under the Contract Documents.
B. Upon completion of the items noted on the Contractor's list, the Contractor shall notify the Architect that the Work is Substantially Complete.
C. The Architect shall then conduct a similar review of the Work. If the Architect agrees that the Work is Substantially Complete, the Architect will promptly review the Work and prepare a punch list, setting forth in detail any items on the Contractor's list and additional items that are not acceptable or incomplete. The Contractor shall coordinate all Subcontractors to achieve prompt completion of the punch list.
D. The Contractor shall not be relieved of the responsibility to provide Contract items left off of the Architect's punch list.
E. If the Architect determines that the Work is not Substantially Complete, the Architect shall inform the Contractor of those items that must be completed before the Architect will prepare a punch list. Upon completion of those items, the Contractor shall again request the Architect to prepare a punch list.
F. When the punch list has been prepared, the Architect will arrange a meeting with the Contractor to identify and explain all punch list items and answer questions on Work which must be done before final acceptance.
G. The Architect may revise the punch list, from time to time, to ensure that all items of Work are properly completed.
H. The Architect shall prepare the Certificate of Substantial Completion.

1.02 RECORD DRAWINGS & PROJECT MANUAL

A. Consult the individual Sections of the Specifications for the specific requirements of those Sections. In cases of inconsistency the more stringent requirement, as directed by the Architect, shall be required.
B. Prior to final payment and completion, the Contractor shall provide all marked up As Built Drawings as required under other Sections of the Specifications. If no specific requirements in other Sections are stated, the Contractor shall prepare two sets of As-Built Drawings with notations clearly delineating any changes to the Work due to Addenda, unforeseen conditions or Change Orders.
C. The Contractor shall submit two blackline copies of the Record Drawings with the date and author of the Record Drawings clearly noted on each sheet. The Architect shall review the Drawings upon submission. If the Record Drawings have been completed to the satisfaction of the Architect, the Architect shall request a set of scanned PDF versions of the Record Drawings to be submitted on two CDs in order to provide electronic supplements to the two hard copies. If the Record Drawings have not been completed to the satisfaction of the Architect, the Architect shall return them to the Contractor with comments for further information as needed.
D. The Contractor shall also markup or revise the Project Manual to make comments reflecting changes during construction. The Record Project Manual shall be dated and marked similarly to the Record Drawings. The submission of two hard copies to the Architect, along with two PDFs on CDs upon acceptance, shall be provided.

1.03 OPERATION & MAINTENANCE MATERIALS

A. Prepare data in the form of an instructional manual. Furnish manuals which contain all of the following groups of equipment.
   1. Special equipment and systems.
   2. Mechanical systems.
   3. Electrical systems.
   4. Interior finishes.

B. Each manual shall include the same following minimum information:
   1. Table of Contents.
   2. Directory of Contractor, subcontractors, and major equipment supplies listing addresses, phone numbers and appropriate emergency phone numbers.
      a. Include local sources of supplies and replacement parts.
   3. Directory of Architect and Consultants listing addresses and phone numbers.
   4. Operation and maintenance instructions provide schematic diagrams of control systems, circuit directories for each electric panel and charts showing the tagging of all valves.
   5. Air and water test and balancing reports.
   6. Maintenance and cleaning instructions for finishes.
   7. Product and manufacturer's Certificates.
   8. Photocopies of all extended warranties and bonds.

C. Submit one copy of completed volume in final form 21 days prior to Final Inspection. This copy will be returned after final inspection with Architect's comments. Revise and submit final bound copies to Owner.

D. For each item of equipment, include description of equipment, component parts and accessories. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts. Additionally provide the following for each item:
   1. Panelboard circuit directories: Provide electrical service characteristics, controls and communications.
   2. Include color-coded wiring diagrams as installed.
   3. Operating procedures: include start-up, break-in and routing normal operating instructions and sequences. Include regulation, control, stopping, shut-down and emergency instructions. Include summer, winter and any special operating instructions.
   4. Maintenance requirements: Include routing procedures and guide for trouble-shooting; disassembly, repair and re-assembly instructions; alignment, adjusting, balancing and checking instruction.
      a. Maintenance drawings: Supplement product data to illustrate relation of component parts of equipment and systems, to show control and flow diagrams. Do not use project Record Documents as maintenance drawings.
   5. Provide servicing and lubrication schedule and list of lubricants required.
   6. Include manufacturer's printed operation and maintenance instructions.
   7. Include sequence of operation by controls manufacturer.
   8. Provide control diagrams by controls manufacturer as installed.
   9. Provide Contractor's coordination drawings, with color-coded piping diagrams as installed.
   10. Provide charts of valve tag numbers with location and function of each valve, keyed to flow and control diagrams.
   11. Provide original manufacturers parts (OEM) list, illustrations assembly drawings and diagrams required for maintenance.
      a. Provide list of original manufacturer's spare parts (OEM) current prices and recommended quantities to be maintained in storage.
      b. Include local sources of supplies and replacement parts and any other data pertinent for procurement procedures.
   12. Additional requirements: As specified in the individual specification Sections.

E. For each interior finish and system, include the following information:

1. Product data with catalog number, size, composition and color and texture designations for all building products, applied materials and finishes. Provide information for re-ordering custom manufacturer products.
2. Instructions for care and maintenance include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods and recommended schedule for cleaning and maintenance.
3. Moisture protection and weather exposed products: Include product data listing applicable reference standards, chemical composition and details of installation. Provide recommendations for inspections, maintenance and repair.
4. Additional requirements: As specified in individual specification Sections.

1.04 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.
B. Deliver materials to on-site location designated by the Owner; obtain receipt.

1.05 DEMONSTRATION AND TRAINING

A. Demonstrating Equipment
   1. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
   3. Utilize operation and maintenance manuals as basis for instruction review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.
   4. Demonstrate start-up operation, control, adjustment, trouble-shooting, servicing maintenance and shutdown of each item of equipment at agreed upon times at equipment location.
   5. Prepare and insert additional data in operations and maintenance manuals specified when need for additional data becomes apparent during instruction.
B. Instruction and Training of Owner's Personnel
   1. Before final inspection, instruct Owner's designated personnel in operation, adjustment and maintenance of products, equipment and systems at agreed upon times.
   2. For equipment requiring seasonal operation, perform instructions for other seasons within six months.
   3. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
   4. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.
   5. Provide sufficient formal instructional time for training Owner's personnel, so that the Owner's personnel will fully comprehend operation and maintenance of the facility's equipment and systems. Contractor's personnel designated for owner training shall be competent and knowledgeable and have good communication skills.
   6. Training sessions shall be pre-arranged directly with the Owner. Instructors shall arrive at pre-scheduled training sessions on time and be fully prepared to teach using a preplanned training program. All instructors are subject to the Owner's approval. Replace unacceptable instructors and reschedule training as directed by the Owner at no increase in cost to the Owner.

7. Training shall include the following:
    a. General overview of Record Documents:
        i. Record Drawings.
        ii. Record Project Manual.
        iii. Operation and Maintenance Manuals.
        iv. Finishes.
        v. Warranty and maintenance agreements.
        vi. Test reports and inspections.
    b. HVAC systems and equipment.
    c. Electrical systems and equipment.

1.06 CONTRACTOR AFFIDAVITS

A. Prior to final payment and completion, the Contractor shall submit affidavits of Payments of Debts and Claims (AIA–G706-1994) and Release of Liens (AIA–G706A–1994).

1.07 FINAL COMPLETION

A. FULL RELEASE OF RETAINAGE
    1. Upon completion of all Work and after receipt of all appropriate Record Drawings, Record Project Manual, Operating Manuals, Warranties, Guarantees, and Spare Parts required by the Contract Documents, the Architect shall prepare the Certificate of Final Completion.
    2. The Contractor's signature on this Certificate shall be notarized.
    3. The Contractor shall provide a final Application for Payment to complement the close-out process.
B. CERTIFICATES OF OCCUPANCY & INSPECTION
    1. Arrange for and provide the Owner with Certificates of Occupancy and Inspection from the Building Department if required by the Town.
C. PERMIT INFORMATION
    1. Provide copies of all permit applications.
    2. Upon completion of the Work, provide copies of permit cards with all authorized signatures indicated.

END OF SECTION

SECTION 02 41 00 - DEMOLITION

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not limited to the following:
   1. Remove floor finishes and framing systems where indicated on the Drawings.
      a. Protect all wood flooring that will be retained, repaired and refinished.
   2. Saw-cut and remove portions of existing slabs and substrate soils for Work related to renovation configurations (elevator pit, lower level, utilities, ejector pit) and trenching for utilities, under-slab piping and under-slab drainage system.
   3. Core-drill exterior masonry foundation walls below grade for pipe sleeves related to underground utilities.
   4. Remove exterior fire escape door and stairs serving the balcony level as noted.
   5. Remove exterior accessible entrance ramp, railings, guard walls and related components in their entirety.
   6. Remove louvers and exterior surface-mounted mechanical, electrical and tel/data devices made redundant by the Work.
   7. Remove wall finishes and wall components to the extent noted on the Drawings.
   8. Remove wood-framed interior walls and portions thereof as indicated on the Drawings. Coordinate with shoring for removal of bearing partitions as needed.
   9. Remove ceilings and selected portions of ceilings as noted on the Drawings.
   10. Remove doors, frames, hardware and/or portions of these existing systems as indicated in the Drawings.
   11. Remove existing wall-mounted wood handrails and brackets.
   12. Remove existing built-in shelving, counters, duct enclosures, wall-mounted items, window coverings, curtain rods, window guards and all other non-original items except where noted to remain in the Drawings.
   13. Remove toilet accessories in existing restrooms and accessories in Kitchen area.
   14. Plumbing, HVAC and Electrical items (MEP) will be made safe by their respective trades to allow for general removal and demolition by the General Contractor.
      a. Except in limited cases where an MEP item is indicated to remain in place for continued use, remove all piping, conduit, devices, wiring, plumbing fixtures, ductwork, fans, radiation, furnaces, hot water heaters, air conditioning units, temperature controls and all other components in their entirety.
   15. Remove asbestos containing materials (ACM) using a subcontractor that is a fully licensed abatement contractor. Remove ACM's and all other hazardous materials as noted in Section 01 35 43 – Environmental Procedures.
   16. Remove and store items that are indicated to be salvaged and re-used. Protect salvaged items from damage during demolition, storage and re-installation.
   17. Remove and legally dispose of all demolished materials off-site.
   18. Recycle construction waste and debris to the extent possible and when required by regulations in order to divert solid wastes from local landfills.
   19. Remove items made redundant by the Work. Remove any previously abandoned items encountered in the process of performing the Work.

20. Remove any other items as indicated on the Drawings, or where not indicated on the Drawings but are made redundant by the Work, including any previously abandoned items that will serve no further purpose.

B. Salvage and store items listed for salvage or reuse as indicated on the Drawings.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this Section. Other Sections that relate directly to work of this Section include, but are not limited to the following:
   1. Section 00 31 19 Existing Conditions.
   2. Section 01 23 00 Alternates.
   3. Section 01 35 43 Environmental Procedures.
   4. Section 02 44 00 Shoring, Bracing & Support.
   5. Section 02 82 00 Asbestos Remediation.
   6. All Divisions in the Project Manual 03 through 33, inclusive.

1.04 SUBMITTALS

A. Submit certificates attesting to legal disposal of refuse materials.
B. Submit “Demolition Schedule of Items” as listed in this Section.

1.05 QUALITY ASSURANCE

A. Protect portions of the building adjacent to or affected by selective demolition.
B. Remove and legally dispose of all demolished materials off-site.
C. Comply with governing codes and regulations. Use experienced workmen.

1.06 PROTECTION

A. Provide for the uninterrupted safety of workers and occupants as well as adjacent structures, finishes, fixtures and existing features during the work. Provide warning signs and barricades as required to maintain a separated, safe, secure work area.
B. Protect all elements that are to remain, including the building and its components, landscaping and site improvements. Do not dismantle anything other than what is specifically indicated on the contract documents unless specifically requested to do so in writing by the Architect.
C. Do not remove any structural elements until finishes have been carefully stripped away and supported elements have been supported by other safe means.
D. Notify the Architect before proceeding with Work if the structural components and configurations differ from what is anticipated by the information detailed in the Drawings.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 GENERAL

A. Perform full review of site and building to verify extent of demolition and dismantling and to plan for coordination with other trades.
B. Carefully study each item to be removed and determine the safest, least disturbing and least potentially damaging method of disassembly. Photograph and identify all elements to be worked on before and after the work.

C. Prepare a DEMOLITION SCHEDULE OF ITEMS for submittal based on the information contained in the Contract Documents and the review of all field conditions. The schedule shall contain the following categories:
   1. Items to be removed from site by Contractor.
   2. Items to remain in place and protected for reuse.
   3. Items to be salvaged for reinstallation in project.
   4. Items to be salvaged and returned to Owner.
D. It is the Contractor's responsibility to request clarification of the intent of the Contract Documents in the event of any ambiguity regarding the removal, disposal, salvage or protection of any item that is in question prior to proceeding with the Work.
E. Remove asbestos-containing materials and other hazardous materials as described in Section 02 82 00 – Asbestos Remediation and Section 01 35 43 – Environmental Procedures.
F. Do not damage existing building elements (all finishes, fixtures, structure, hardware, etc.) and site improvements (all landscaping, pavings, fixtures, furniture, etc.) in or outside of the area of Work and intended to remain in place, undisturbed.
G. Items of salvage value and not included on schedule of salvage items to be returned to Owner may be removed and become the property of the Contractor. Storage or sale of items at the project site is prohibited.
H. Do not proceed with selective demolition until adequate temporary protection and required temporary shoring and bracing have been installed where applicable. Cease operations if public safety or existing features are endangered. Perform temporary corrective measures until operations can be continued properly.
I. Do not proceed with selective demolition until applicable debris netting and temporary dust curtains or dust/noise partitions have been installed and sealed in order to prevent the migration of dust and debris to adjacent areas as applicable.
J. Take all precautions as required by law for the removal and disposal of debris and dispose of in accordance with applicable regulations.
K. Do not close or obstruct streets, walks, drives or other occupied or used spaces or facilities without the written permission of the Owner and authorities having jurisdiction.
L. Do not block any required means of egress at any time during the construction period without providing alternate means that are well identified and approved by the Owner, Architect and authorities having jurisdiction.
M. Do not interrupt utilities serving the building without the provision of temporary replacement services or without written approval from the Owner.
N. Dismantle and salvage the specific items and store in a safe place for re-assembly.
O. Notify the Architect immediately if any damage has occurred to the existing building, site or any dismantled and salvaged items. Propose appropriate methods of repair and restoration so that any visual, structural or functional evidence and effect of damage is eliminated to the satisfaction of the Architect and Owner.
P. If an item indicated to remain or be salvaged is damaged or destroyed, the Contractor shall repair or replace the missing or damaged item or an equivalent and shall bear any costs associated with its restoration.

END OF SECTION

SECTION 02 41 13 – SITE PREPARATION AND CLEARING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

This section is only a portion of the Contract Documents. All of the Contract Documents, including Conditions of the Contract and Division 1 General Requirements, apply to this section.

1.02 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, and services necessary to complete the work of this Section as specified herein, as shown on the drawings, or both.

B. The work of this Section includes, but is not limited to, the following:

1. Staking layout, limits of work and extent of grading
2. Erosion and sedimentation control
3. Tree protection
4. Saw cutting existing pavement
5. Removing bituminous concrete pavement
6. Removing curbing
7. Clearing and grubbing
8. Demolition, removal from the site and legal disposal of all existing above grade and subsurface improvements as indicated on the Drawings and as required by the work of this Contract
9. Salvage indicated materials
10. Protection of existing improvements to remain

1.03 RELATED WORK

A. Carefully examine all of the Contract Documents for requirements that affect the work of this Section. Other specification sections that directly relate to the work of this Section include, but are not limited to, the following:

1. Section 01 23 00 – Alternates
2. Section 01 50 00 - Temporary Facilities and Controls
2. Section 31 20 00 – Earthwork (includes stripping topsoil)
3. Section 32 12 00 – Asphalt Paving

1.04 PROJECT CONDITIONS

A. It is hereby understood that the Contractor has carefully examined the site and all conditions affecting work under this Section. No claim for additional cost will be allowed because of lack of full knowledge of existing conditions.

B. Preparation and Workmanship: Except as otherwise specified, site preparation, demolition work and clean up shall be the work of the Contractor. Any item of work not specifically designed to be accomplished by a particular subcontractor shall be considered work of the Contractor.

C. Traffic: Conduct site clearing and demolition operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

D. Protection of Existing Improvements: Provide protection necessary to prevent damage to existing buildings, paving, services and all other improvements indicated to remain in place. Locate and identify existing underground utilities within project limit lines. Provide adequate means of protection of all utilities to remain. The Contractor shall contact “Dig-Safe” at 1-888-344-7233 prior to beginning any excavation work. The Contractor shall be solely responsible for locating all underground utilities prior to the commencement of work. Locations of existing utilities on the site plans are not warranted to show all existing utilities under or above ground. Existing utilities indicated on the site plans are shown only for the convenience of the Owner’s representatives.

   1. Protect improvements and surfacing on Owner’s property.

   2. Restore improvements damaged during construction to their original condition, as acceptable to the parties having jurisdiction.

E. Protection of existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, damaging heat from paving equipment, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards, fencing or any other necessary precautions to protect trees and vegetation to remain.

   1. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during the course of construction operations.

   2. Repair trees and vegetation indicated to remain that are damaged by construction operations, in a manner acceptable to the Architect. Employ a licensed arborist to repair damage to trees and shrubs.

   3. Replace trees and vegetation that cannot be repaired and restored to full-growth status, as determined by a licensed arborist.

F. Dust and Pollution Control: Provide dust control for dust generated by the work of this project. Dampen surface as required or use other approved method. Comply with pollution control requirements of the governing authority.

G. Salvageable Improvements: Carefully remove items indicated to be salvaged or reused, and store at the site for future use. Protect such items from accidental damage, vandalism and theft.

H. Bench Marks: Locate, protect and maintain bench marks, monuments, control points and project engineering reference points.

I. Regulatory controls: All work within this Section must comply with the requirements of all authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS AND PRODUCTS

A. Erosion and Sedimentation Control: Materials for erosion and sedimentation control shall be as described herein and as shown on the Drawings.

1. Commercial grade haybales shall be baled hay or straw baled within twelve months of use. Bindings shall be biodegradeable jute twine sufficiently strong to act as handles without breaking when placing bales in position by hand. The minimum dimension of any bale shall be 18-inches. Wood stakes shall be oak, 1-inch by 1-inch in section, and at least 3.0 feet in length.

2. Silt fence shall be Amoco 2155 having a reinforcement strap at the top of the fabric for post attachment.

3. Catch basin filters shall be SiltSack by ACF Environmental 1-800-448-3636 or approved equal. Provide regular flow (40 gal./min./ft.^{2}) or high flow (200 gal./min./ft. ^{2}) as required to provide positive drainage of all contributing areas.

4. Erosion control mat: Refer to Section 32 92 00 Turf and Grasses.

5. Filter fabric: Refer to Section 31 20 00 – Earthwork

6. Compost Filter Sock: Install biodegradable compost filter sock in accordance with the Drawings. Product shall SiltSoxx by Filtrexx 440-926-2607 or approved equal. Filter sock shall be filled with compost which shall be dispersed on site following use.

7. Straw wattles shall be composed of 100% agricultural straw and wrapped in tubular UV stabilized synthetic net. Netting shall be .35 oz/LF and made from HDPE photodegradeable net with .5 inch openings. Ends shall be be secured with wire closures and installed in accordance to manufacturer's recommendations

B. Tree protection materials shall be hardwood posts/stakes, contractor grade orange plastic fence, galvanized steel hardware installed as described herein.

PART 3 - EXECUTION

3.01 SITE ENGINEERING / LAYOUT

A. Prior to the start of clearing and excavation operations, lay out and stake out the building additions, paved areas, limits of cut and fill and work limit lines for the Architect's review.

B. Promptly upon completion of layout work, and before any clearing or other construction work is begun, the Contractor shall arrange fa conference on the site with the Architect and Conservation Commission representative to inspect and verify the limits of work areas staked out.

3.02 EROSION AND SEDIMENTATION CONTROL

A. Intent: The Contractor is responsible for providing all erosion and siltation controls shown on the Drawings as well as all temporary erosion control measures required to control erosion of soils within the areas of clearing, grubbing and earthwork operations. The Contractor shall carry a contingency as part of his base bid contract price to provide temporary erosion controls to be installed during construction as required to contain water bourne sediments within the project work area and prevent siltation of open or subsurface drainages systems.

B. Haybale rows and check dams shall be constructed in accordance with the details indicated on the Drawings, and as specified herein. Install haybale check dams at all temporary and permanent drainage swales in accordance with the Detail. Haybales shall be installed in the following manner:

1. Bales shall be placed in a single row with ends of adjacent bales tightly abutting one another.

2. The erosion check shall be entrenched and backfilled. The trench shall be excavated the width of the bale and the length of the check to a minimum depth of 3-inches. After the bales are staked and chinked, the excavated soil shall be backfilled against the check. Backfill shall conform to the ground level on the downhill side and shall be built up to 4-inches against the uphill side.

3. Each bale shall be securely anchored by at least two stakes driven through the bale. The first stake in each bale shall be driven toward the previously laid bale to force the bales together.

4. The gaps between bales shall be chinked (filled by wedging) with straw to prevent water from escaping between bales. Loose straw shall be scattered over the area immediately uphill from the bale erosion check to increase efficiency.

5. Haybale removal: All stakes must be removed from the haybales at a time designated by the Architect and only when the adjacent exposed area has been stabilized, i.e., the area has an established grass or stone cover or has been paved, and is free from future uncontrolled discharges. Prior to such removal, however, all silt, mud, and debris entrapped by the haybales shall be removed and the area cleaned up in accordance with the applicable provisions of these Specifications. Immediately upon removal of the bales the remaining exposed areas (under the bales) will be backfilled, raked, and graded as necessary to match the surrounding grade and then seeded.

C. Silt fence shall be constructed at the locations, and in accordance with the details indicated on the Drawings and as specified herein. The silt fence shall be installed in the following manner:

1. A 6-inch x 6-inch minimum trench shall be dug where the fence is to be installed.

2. The fence shall be positioned in the trench with the fence posts set at 8-feet on center (maximum).

3. The sedimentation control fabric and the industrial netting shall be stapled to each post. When joints are necessary, filter fabric shall be spliced together only at support posts. Splices shall be in accordance with the Detail.

4. Each wood post with industrial support netting and filter fabric attached shall be driven into the undisturbed soil in the trench as indicated on the Plans. Attach the reinforcement strap in the sedimentation control fabric to each post.

5. The trench shall be backfilled and the soil compacted over the filter fabric.

6. The installed height of the fence shall be 2.5 feet (minimum).

7. Silt fence removal: This work will include the removal of the silt fence and posts. The silt fence shall be removed only when the adjacent exposed area is stabilized, i.e., the area has an established grass or stone cover or has been paved, and is free from future uncontrolled discharges. Prior to such removal, however, all silt, mud, and debris entrapped by the silt fence shall be removed and the area cleaned up in accordance with the applicable provisions of these Specifications. Immediately upon removal of the silt fence the remaining exposed areas will be backfilled, raked, and graded as necessary to match the surrounding grade and then seeded.

D. Catch basin filters shall be installed at all existing catch basins to remain, at all catch basins to be removed (prior to their removal) that are connected to drainage pipes to remain and at all new catch basins.

1. Install catch basin filters in conjunction with haybales as indicated on the Detail, prior to any catch basin described above becoming exposed to any siltation.

2. Remove and replace catch basin filters as indicated on the Detail and as required to permit sufficient water flow to provide positive drainage of all contributing areas

3. Erosion control mat: Refer to Section 32 92 00 Turf and Grasses.

4. Filter fabric: Refer to Section 31 20 00 – Earthwork.

3.03 REMOVAL OF TREES AND SHRUBS

A. Remove trees and shrubs as indicated on the Drawings.

B. Prior to starting any construction work, erect tree protection where shown and as detailed on the Drawings and where directed by the Architect in the field

C. Grubbing: Completely remove stumps and roots of vegetation indicated to be removed.

D. All materials from clearing operations shall be removed from the site prior to or by the end of the clearing operations. On-site disposal will not be allowed.

E. Fill holes, depressions caused by clearing and grubbing operations with ordinary fill conforming to EARTHWORK unless additional earthwork is to be done at location of hole or depression. Place fill in horizontal layers, 6 inches in loose depth, and compact to a density equal to adjacent undisturbed material.

F. Without exception, any area cleared for any reason by the Contractor, inside or outside the Limit of Work Line and not otherwise developed shall be loamed and seeded by the Contractor in accordance with provisions of Section PLANTING, at no additional cost to the Owner.

G. Tree clearing shall include as many separate mobilizations as required by the Contractor's sequence of operations due to the phased nature of the project. A selective clearing operation shall be performed by the Contractor after rough grading has been completed, to remove trees, stumps and vegetation at the limits of cuts and fills as directed by the Architect in the field.

3.04 PROTECTION AND PRUNING OF EXISTING PLANT MATERIAL TO REMAIN

A. Within the limit of work lines protect all plant materials to remain as indicated on the Drawings. No such plant materials shall be used as guys or other fastenings.

B. The Contractor shall not cause any damage to trees to remain. If in order to perform excavation work, it becomes necessary to cut roots of plants to be saved, such roots shall be neatly cut after consulting the Architect.

3.05 BITUMINOUS CONCRETE

A. Remove and legally dispose of all bituminous concrete paving indicated on the Drawings to be removed and all other paving required to be removed in order to construct the Project.

B. Saw cut existing bituminous paving at all locations where where new pavement meets existing pavement to remain. Sawcuts shall be made with sharp tools and blades to provide a clean, straight and vertical cut line. Use carbide or other type blade intended for that purpose.

3.06 ABOVE AND BELOW GRADE IMPROVEMENTS

A. Remove and legally dispose of all existing above and below grade improvements necessary to permit construction of the Project, including pipes, tanks, concrete slabs, castings, curbing and any and all other improvements inside or outside the contract limits. Remove walls and other obstructions to a depth of at least 2 feet below finished grades and as required to construct the subsurface improvements of this project.

B. Abandonment, relocation, partial removal or complete removal of certain existing underground and above ground utilities including, but not limited to pipes, tanks, castings, conduits, electrical wiring and poles is as shown on the Drawings.

3.07 SALVAGING MATERIALS

A. The Architectural and Landscape Drawings depict specific memorial artifacts to be salvaged and relocated in the new design. The Contractor shall review these items in person with the Architect prior to any site demolition in these areas.

B. Salvaged items shall be carefully removed, cleaned and stored in a protected area until the new site conditions are prepared for their reinstallation.

3.08 DISPOSAL OF WASTE MATERIALS

A. Removal from Owner's property: Remove all waste materials from Owner's property in timely and responsible manner and legally dispose of off-site. Accumulation is not permitted. Maintain disposal routes clear, clean and free of debris. Dumping and / or burning of material on site will not be permitted.

3.08 CLEAN UP

A. Keep pavements and areas adjacent to and leading from the site, clean and free of mud, dirt and debris.

B. At completion of the work of this Section, remove materials generated by site clearing. Do not spill or disperse debris on the site. Leave the site in a safe and clean condition acceptable to the Architect.

END OF SECTION

SECTION 02 44 00 – SHORING, BRACING AND SUPPORT

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to Division 00 and Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.

B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 INCLUDED IN THIS SECTION

A. Design and installation of all required temporary shoring, bracing and support to enable the necessary structural repairs, alterations and masonry restoration work to be completed in a safe and expedient manner.

1.03 REFERENCES

A. Comply with the following standard material specifications that apply to the materials used.

1.04 SUBMITTALS

A. Submit the following items to the Architect for review:
   1. Drawings showing shoring, bracing, and temporary supports for areas of structural modifications.
   2. A written sequence of all phases of restoration operations and related temporary support

1.05 QUALITY ASSURANCE

A. Comply with all referenced standards for the products employed.

B. Schedule all appropriate site visits and inspections with the design Structural Engineer of Record for the shoring system.

PART 2 - PRODUCTS

2.01 PRODUCTS AND MATERIALS

A. Products and materials that are appropriate to the application and permitted by the Massachusetts State Building Code.

PART 3 - EXECUTION

3.01 TEMPORARY SHORING, BRACING AND SUPPORT

A. The contractor shall be solely responsible for all means and methods of construction employed on this project including all temporary bracing, support and protection of the existing Structure. The Contractor shall retain the services of a Massachusetts registered professional structural engineer at his own expense as required to

maintain safe and stable conditions on the project. Any sequences of work or methods indicated or implied in the contract documents are present only as assumptions on which the design of the permanent installations are based and are to be considered as a suggested option for review by the contractor.

B. Field Survey and Analysis:
   1. Select shoring, bracing and support locations and measure all existing geometry and note existing conditions. Locate points of attachment and support that will best suit progress of work.
   2. Perform a structural analysis of the areas to be affected by the work and determine loads on temporary shoring, bracing and support system.

C. Design Shoring, Bracing and Support:
   1. Shoring, bracing and support shall be designed to maintain existing lines and surfaces without deflection during work. Design shall be in accordance with gravity dead, live and wind load resistance requirements of the Massachusetts State Building Code. Design shall be sufficient for existing and new material loads and anticipated construction loads.
   2. Design shall allow for distribution of loads to supporting structure and shall limit all movement to less than 1/16" at full loading. Stresses on supporting structure shall not exceed safe, commonly allowable stresses for the materials in consideration of their age and conditions. Bending members shall allow deflections of not more than the supported elements can accommodate without damage or excessive stress and shall additionally be limited to the span lengths divided by 600 at full loading.
   3. Minimize use of side grain bearing timbers that may be susceptible to dimensional variations with changes in moisture and temperature. Seal all end grain.

D. Construct shoring, bracing and support in accordance with approved design submittal and proper and standard construction practice. Work shall be installed so as not to permanently mar or stain the exposed stone faces of the structure.

E. Maintenance: Maintain shoring, bracing and support in a safe condition during all phases of work. Keep wood generally dry and of constant moisture content. Protect wood from swelling or shrinking with weather and humidity fluctuations. Remove all shoring and bracing after surrounding work is complete.

END OF SECTION

SECTION 02 82 00 - ASBESTOS REMEDIATION

PART I - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.02 RELATED WORK UNDER OTHER SECTIONS

A. Environmental Procedures, Section 01 35 43

1.03 DESCRIPTION OF WORK

A. The work includes the complete removal and disposal of all asbestos containing materials (ACM) as indicated in Part 3 of this Section.

B. The General Contractor shall retain the services of a Massachusetts licensed asbestos abatement subcontractor. The asbestos must include in his scope of work all required services as described in Part 3 of this Section and must accept the Unit Prices included at the end of this Section to be used for add/deducting.

1.04 POTENTIAL ASBESTOS HAZARD & DEBRIS

A. Where in the performance of the work, workers, supervisory personnel, subcontractors, or consultants may encounter, disturb, or otherwise function in the immediate vicinity of any identified ACM, take appropriate continuous measures as necessary to protect all building occupants from the potential hazard of exposure to airborne asbestos. Such measures shall include the procedures and methods described herein, and compliance with regulations of applicable federal, state, and local agencies.

B. If the Asbestos Subcontractor fails to comply with the requirements of the specifications, the Owner's Representative (Industrial Hygienist) may present a written stop of work order. The Subcontractor must immediately and automatically stop all work until authorized in writing by the Industrial Hygienist to commence work. All costs related to delays shall be at the Subcontractor’s expense.

1.05 DEFINITIONS

A. Abatement: Procedures to control fiber release from ACM. Includes encapsulation, enclosure, and removal.

B. Air Monitoring: The process of measuring the fiber content of a specific volume of air in a stated period of time.

C. Asbestos: The name given to a number of naturally occurring hydrated mineral silicates that possess a unique crystalline structure are incombustible and are separable into fibers. Asbestos includes Chrysotile, Crocidolite, Amosite, Anthophyllite, and Actinolite.

D. ACM: Any material containing more than 1% or greater by weight of asbestos of any type or mixture of types. State laws may vary in their definition of asbestos containing material.

E. Barrier: Any surface that seals off the work area to inhibit the movement of fibers.

F. Critical Barrier: A solid, asbestos impermeable partition erected so as to constitute a work area closure; the outer perimeter of an asbestos work area, usually erected across corridors or other open spaces to complete containment.

G. Designer: Commonwealth of Massachusetts Licensed Designer Ammar Dieb, Universal Environmental Consultants (AD-900326), Expiring 5/2022.

H. Enclosure: All herein specified procedures necessary to complete enclosure of all ACM behind air-tight, impermeable, permanent barriers.

I. Friable Asbestos Material: Material that contains more than one percent asbestos by weight and that can be crumbled, pulverized, or reduced to powder by hand pressure when dry.
J. HEPA Filter: A High Efficiency Particulate Absolute (HEPA) filter capable of trapping and retaining 99.97% of asbestos fibers greater than 0.3 microns in length.
K. Industrial Hygienist: An industrial hygienist certified in the Commonwealth of Massachusetts to perform air monitoring.
L. Removal: All herein specified procedures necessary to strip all ACM from the designated areas and to dispose of these materials at an acceptable site.
M. Respirator: A device designed to protect the wearer from the inhalation of harmful atmospheres.
N. Visible Emissions: Any emissions containing particulate asbestos material that are visually detectable without the aid of instruments. This does not include condensed uncombined water vapor.
O. Wet Cleaning: The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning tools which have been dampened with water, and by afterwards disposing of these cleaning tools as asbestos contaminated waste.
P. Work Area: Any area of the building or site that is set up for an asbestos abatement area or as areas containing friable asbestos material.
Q. Worker Decontamination Enclosure System: A decontamination enclosure system for workers, typically consisting of a clean room, a shower room, and an equipment room.

1.06 STOP WORK

A. If the Owner or the Industrial Hygienist presents a written stop work order, immediately and automatically stop all work. Do not recommence work until authorized in writing by the Industrial Hygienist and or Designer.

1.07 SUBCONTRACTOR'S USE OF THE EXISTING BUILDING

A. Keep existing driveways and entrances serving the premises clear and available to the Owner and his employees at all times. Do not use these areas for parking or storage of materials, unless authorized in writing by the Owner.
B. Smoking or open fires will not be permitted within the building enclosure or on the premises.

1.08 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. Provide a full time Site Supervisor for work under this Section with all appropriate state licenses, who is experienced in administration and supervision of asbestos abatement projects including work practices, protective measures for building and personnel and disposal procedures. This person is the Competent Person in accordance with 29 CFR 1926 and with all applicable federal, state, and local regulations, particularly those relating to ACM. This person shall have completed a course at an EPA Training Center or equivalent certificate course in asbestos abatement procedures, have had a minimum of two years on the job training and meet all additional requirements set forth in 29 CFR 1926 for a Competent Person.
B. The Site Supervisor must be certified by the State of Massachusetts. Asbestos Subcontractor shall provide proof of such certification to the Industrial Hygienist not less than 10 days prior to commencing any work.

1.09 SPECIAL REPORTS

A. Except as otherwise indicated, submit special reports directly to the Industrial Hygienist within one day of occurrence requiring special report, with copies to all others affected by the occurrence.

B. When an event of unusual and significant nature occurs at the site (examples: failure of negative pressure system, rupture of temporary enclosures, unauthorized entry into work areas), prepare and submit a special report listing date and time of event, chain of events, persons participating, response by Subcontractor's personnel, evaluation of results or effects, and similar pertinent information. When such events are known or predictable in advance, advise the Industrial Hygienist in advance at earliest possible date.

C. Prepare and submit special reports of significant accidents, at the site and anywhere else work is in progress related to this project. Record and document data and actions; comply with industry standards. For this purpose, a significant accident is defined to include events where personal injury is sustained, or property loss of substance is sustained, or where the event posed a significant threat of loss or personal injury.

1.10 CONTINGENCY PLAN

A. Prepare a contingency plan for emergencies including fire, accident, power failure or any other event that may require modification of decontamination or work area isolation procedures. Include in the plan specific procedures for decontamination or work area isolation. A copy of the plan shall be submitted to and approved by the Industrial Hygienist prior to any work being done.

B. Post in the clean room of the decontamination unit and in the Subcontractor's office trailer telephone numbers and locations of emergency services including but not limited to fire, ambulance, doctor, hospital, and police.

1.11 PERMITS AND NOTIFICATIONS

A. Secure necessary permits in conjunction with asbestos removal, hauling, and disposition and provide timely notification as may be required by federal, state, regional, and local authorities. Notify the Department of Environmental Protection (DEP) and the Massachusetts Department of Labor Standards (DLS) and provide copies of the notification to the Industrial Hygienist, Industrial Hygienist, and the State Environmental Regulatory Agency 10 working days (Document Submission Date) prior to commencement of the work.

B. No later than the Document Submission Date, notify the local fire, police, and Health Departments, in writing, of proposed asbestos abatement work. Advise the fire department of the nature of the asbestos abatement work, and the necessity that all firefighting personnel who may enter the work site in the case of fire wear self-contained breathing apparatus. Provide one copy of the notices to the Industrial Hygienist prior to commencing the work.

C. No later than the Document Submission Date, submit proof satisfactory to the Industrial Hygienist that all required permits, site location, and arrangements for transport and disposal of asbestos containing or contaminated materials, supplies, and the like have been obtained.

1.12 SAFETY COMPLIANCE

A. Comply with laws, ordinances, rules, and regulations of federal, state, regional, and local authorities regarding handling, storing, transporting, and disposing of asbestos waste materials.

B. Comply with the applicable requirements of the current issue of 29CFR 1926.1101 and 40CFR 61, Subparts A and B. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting the work.

1.13 RESPIRATOR PROGRAM

A. Establish a respirator program by ANSI Z88.2 and 29 CFR 1926.1101 (h), 1926.l03, and l9l0.l34.

1.14 PERSONNEL PROTECTION

A. Prior to commencement of work, workers shall be instructed in and shall be knowledgeable of the hazards of asbestos exposure; use and fitting of respirators; use of showers; entry and exit from work areas, and all aspects of work procedures and protective measures.

B. All asbestos abatement workers shall receive training and shall be accredited per 40 CFR 763.90(g). Training and accreditation shall be in accordance with 40 CFR 763, Appendix C to Subpart E. Training shall also be provided to meet the requirements of OSHA Regulations contained in 29 CFR 1926.

C. Prior to the start of work, the Asbestos Subcontractor shall provide medical examinations for all employees in accordance with 29CFR 1926.1101 (m). All employees hired by the Asbestos Subcontractor after start of work shall have medical examinations in accordance with this paragraph before being put to work.

D. Maintain complete and accurate records of employee's medical examinations, during employment and make records of the required medical examinations available for inspection and copying to: The Assistant Secretary of OSHA, the Director of The National Institute for Occupation Safety and Health (NIOSH), authorized representatives of either of them, and an employee's physician upon the request of the employee or former employee.

E. Provide personnel exposed to airborne concentrations of asbestos fibers with fire retardant disposable protective whole-body clothing, head coverings, gloves, and foot coverings. Provide gloves to protect hands. Make sleeves secure at the wrists and make foot coverings secure at the ankles by the use of tape. Asbestos Subcontractor shall require and monitor the use of complete protective clothing. A competent person designated by the Asbestos Subcontractor in accordance with 29CFR 1926.1101 shall periodically examine protective clothing worn by employees in the work area for rips or tears. When rips or tears are detected, they shall be immediately mended or replaced.

F. Provide goggles to personnel engaged in asbestos operations when the use of a full-face respirator is not required.

G. Provide authorized visitors with suitable protective clothing, headgear, eye protection and footwear, whenever they are required to enter the work area, to a maximum of 3 changes for 3 visitors per day. One of the sets of protective clothing shall be available for full time use by the Industrial Hygienist.

H. Provide all persons with personally issued and marked respiratory equipment approved by NIOSH and OSHA. The appropriate respiratory protection shall be selected according to the most recent Massachusetts regulations.

I. Once all visible asbestos material has been removed during decontamination, cartridge type respirators will be allowed during the final cleanup provided the measured airborne concentrations do not exceed 0.1 fibers per cubic centimeter. Where respirators with disposable filters are employed, provide sufficient filters for replacement to the worker or applicable regulation.

J. If the permissible respirators fail to provide sufficient protection against volatile emitted by any sealant used, the services of a qualified industrial hygienist will be procured, at the Asbestos Subcontractor's expense, to determine proper respiratory protection. The Owner and Industrial Hygienist will not be liable for the cost of increased respiratory protection.

K. Select respirators from those approved by the Mine Safety and Health Administration (MSHA), Department of Labor, or the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services. All personnel wearing negative pressure respirators shall have respirator fit tests within the last six months and signed statements shall be available.

1.15 REFERENCE STANDARDS

A. Unless otherwise indicated, all referenced standards shall be the latest edition available at the time of bidding. Requirements of this Section shall in no way invalidate the minimum requirements of the referenced standards. Comply with the provisions of the following codes and standards, except as otherwise shown or specified. Where conflict among requirements or with this Section exists, the more stringent requirements shall apply.

B. U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA) requirements, which govern asbestos abatement work or hauling and disposal of asbestos waste materials.

C. U.S. Environmental Protection Agency (EPA) requirements, which govern asbestos abatement work or hauling and disposal of asbestos waste materials.

D. U.S. Department of Environmental Protection (DEP) 310CMR 7.15 and the Massachusetts Department of Labor Standards (DLS) 454CMR 28.

1.16 SUBMITTALS

A. No work shall commence until the Asbestos Subcontractor submits an emailed completed submittal not less 10-working days prior to commencement of the work. The submittals shall include the following:

1. Submit all licenses and certification required.
2. Submit written evidence that the landfill to be used for disposal of asbestos is approved for disposal of asbestos by the EPA.
3. Submit all required items previously listed.
4. Secure necessary permits in conjunction with asbestos removal, hauling, and disposition and provide timely notification as may be required by federal, state, regional, and local authorities. Notify the Department of Environmental Protection (DEP) and the Massachusetts Department of Labor Standards (DLS) and provide copies of the notification.
5. Notify the local fire, police, and Health Departments, in writing, of proposed asbestos abatement work. Advise the fire department of the nature of the asbestos abatement work, and the necessity that all firefighting personnel who may enter the work site in the case of fire wear self-contained breathing apparatus. Provide one copy of the notices.
6. Submit proof that all required permits, site location, and arrangements for transport and disposal of asbestos containing or contaminated materials, supplies, and the like have been obtained.
7. The Subcontractor shall submit a plan for managing the waste including all collection, storage, disposal, and decontamination practices/waste disposal.
8. Submit medical examinations for all employees in accordance with 29CFR 1926.1101 (m). All employees hired by the Asbestos Subcontractor after start of work shall have medical examinations in accordance with this paragraph before being put to work.
9. Provide MSDS for all used products on this Project.
10. Submit the negative pressure system. Do not begin work until the Industrial Hygienist approves the submittal. Include in the submittal at a minimum:
    a. Number of negative air machines required and the calculations necessary to determine the number of machines.
    b. Description of projected airflow within the work area and methods required providing adequate airflow in all portions of the work area.
    c. Location of machines in the work area.
    d. Location of pressure differential measurement equipment.
    e. Manufacturers product data on equipment used to monitor pressure differential.
11. Submit for approval the form of security and safety log, which will be maintained on the project.
12. Submit written evidence that the landfill to be used for disposal of asbestos is approved for disposal of asbestos by the Department of Environmental Protection.

13. Submit proof that training requirements as specified in 29CFR 1926.1101 (k) (3) and by appropriate state agencies has been complied with.
14. Submit a description of the plans for construction of decontamination enclosure systems and for isolation of the work areas in compliance with this specification and all applicable regulations.
15. Submit a detailed schedule including work dates, work shift time, number of employees, dates of start and completion of all work activities (including mobilization, work area preparation, asbestos abatement, inspection and clearance monitoring, each phase of refinishing, and final inspections). Schedule shall be updated with each request for payment of completed work to be submitted to the General Contractor.

1.17 REPORTING

A. Maintain on site a daily log documenting the dates and time of the following items, as well as other significant events:
   1. Minutes of meetings: purpose, attendees, and brief discussion
   2. Visitations: authorized and unauthorized
   3. Personnel: by name, entering and leaving the work area
   4. Special or unusual events
   5. Personnel air monitoring tests and results

B. Documentation with confirmation signature of the Industrial Hygienist of the following:
   1. Inspection of work area preparation prior to start of removal and daily thereafter.
   2. Removal of any polyethylene barriers.
   3. Removal of waste materials from work area and transport and disposal at approved site.
   4. Waste Shipment Records. No final payment will be approved until all above documents have been submitted.

C. Provide two bound copies of this log to the Industrial Hygienist with the application for final payment.

1.18 AIR MONITORING

A. Throughout the entire removal and cleaning operations, air monitoring will be conducted to ensure that the Asbestos Subcontractor is complying with the EPA and OSHA regulations and any applicable state and local government regulations. The Owner will provide an Industrial Hygienist (Universal Environmental Consultants) to take air samples at the job site at no cost to the Asbestos Subcontractor.

B. The purpose of the Industrial Hygienist's air monitoring will be to detect faults in the work area isolation such as:
   1. Contamination of the building outside of the work area with airborne asbestos fibers,
   2. Failure of filtration or rupture in the negative pressure system,
   3. Contamination of the exterior of the building with airborne asbestos fibers.
   4. Should any of the above occur, the Asbestos Subcontractor should immediately cease asbestos abatement activities until the fault is corrected! Work shall not recommence until authorized by the Industrial Hygienist.

C. The Industrial Hygienist will monitor airborne fiber counts in the work area. The purpose of this air monitoring will be to detect airborne fiber counts higher than the Action Level of 0.1-f/cc which may significantly challenge the ability of the work area isolation procedures to protect the balance of the building from contamination by airborne fibers.

D. The Asbestos Subcontractor shall be responsible for providing his/her own personnel monitoring within the work area in accordance with CFR 1926.1101.

1.19 AIRBORNE FIBER COUNTS

A. If any air sample taken outside of the work area exceeds the base line (background) conducted by the Industrial Hygienist, immediately and automatically stop all work. If this air sample was taken inside the building and outside of critical barriers around the work area, immediately erect new critical barriers to isolate the affected area from the balance of the building.
   1. Respiratory protection shall be worn in affected area.
   2. Leave critical barriers in place until completion of work and ensure that the operation of the negative pressure system in the work area results in a flow of air from the balance of the building into the affected area.
   3. A final inspection after removal of poly shall be completed by the Asbestos Subcontractor's Supervisor and the Industrial Hygienist.

B. The following procedure shall be used to resolve any disputes regarding fiber types when work has been stopped due to excessive airborne fiber counts. "Airborne Fibers" referred to above include all fibers regardless of composition as counted in the NIOSH 7400 Procedure. If work has stopped due to high airborne fiber counts, air samples will be secured in the same area by the Industrial Hygienist for analysis by Transmission Electron microscopy (TEM). Airborne Fibers counted in samples analyzed by TEM shall be only asbestos fibers, but of any diameter and length. Subsequent to analysis by TEM the number of "Airborne Fibers" shall be determined by multiplying the number of fibers, regardless of composition, counted by the NIOSH 7400 procedure by a number equal to asbestos fibers counted divided by all fibers counted in the TEM analysis.

C. If TEM is used to arrive at the basis for determining "Airborne Fiber" counts in accordance with the above paragraph, and if the average of airborne asbestos fibers in all samples taken outside the work area exceeds the base line, then the cost of such sampling and analysis will be borne by the Asbestos Subcontractor.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Plastic Sheet: 6 mil minimum thickness, unless otherwise specified, in sizes to minimize the frequency of joints.

B. Tape: Capable of sealing joints of adjacent sheets of plastic and for attachment of plastic sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under dry and wet conditions, including use of amended water. Provide tape, which minimizes damage to surface finishes.

C. Cleaning Materials: Use materials recommended by manufacturer of surface to be cleaned. Use cleaning materials only on surfaces recommended by the cleaning material manufacturer.

2.02 EQUIPMENT

A. Supply the required number of asbestos air filtration units to the site in accordance with these specifications.

2.03 DANGER SIGNS AND LABELS

A. Display danger signs at each location where airborne concentrations of asbestos fibers may be in excess of 0.0l fibers/cc. Post signs at such a distance from such a location so that an employee may read the signs and take necessary protective steps before entering the area marked by the signs.

B. The sign shall also contain a pictorial representation of possible danger or hazard, such as a skull and cross bone, or other suitable warning as approved by the Industrial Hygienist. Sign shall meet the requirements of 29CFR 1926.200. A sample of the signs to be used shall be submitted to the Industrial Hygienist for approval prior to beginning work area preparation.

C. Affix danger labels to all raw materials, mixtures, scrap, waste, debris, and other products containing asbestos fibers, or to their containers.

2.04 PERSONNEL DECONTAMINATION UNIT

A. Prior to any asbestos abatement work, including placement of plastic on walls that will contact or disturb asbestos containing surfaces, or removal of light fixtures or any items on asbestos containing surfaces, construct a Personnel Decontamination Unit consisting of a serial arrangement of connected rooms or spaces, Changing Room, Shower Room, and Equipment Room. Require all persons without exception to pass through this decontamination unit for entry into and exiting from the work area for any purpose.

B. Build suitable framing or use existing rooms, with the Industrial Hygienist written approval, connected with framed in tunnels if necessary; line with 6 mil plastics; seal with tape at all lap joints in the plastic for all enclosures and decontamination enclosure system rooms. Decontamination units and access tunnels constructed outside shall be constructed with tops made of 5/8" plywood or approved equal. In all cases, access between contaminated and uncontaminated rooms or areas shall be through an airlock. In all cases, access between any two rooms within the decontamination enclosure systems shall be through a curtained doorway.

C. Provide a changing (clean) room for the purpose of changing into protective clothing. Construct using polyethylene sheeting, at least 6-mil in thickness, to provide an airtight seal between the Clean Room and the rest of the building. Locate so that access to work area from Clean Room is through Shower Room. Separate Clean Room from the building by a sheet polyethylene flapped doorway.

D. Require workers to remove all street clothes in this room, dress in clean disposable coveralls, and don respiratory protection equipment. Do not allow asbestos contaminated items to enter this room. Require workers to enter this room either from outside the structure dressed in street clothes, or naked from the showers.

E. An existing room may be utilized as the changing room if it is suitably located and of a configuration whereby workmen may enter the Clean Room directly from the Shower Room. Protect all surfaces of room with sheet plastic. Authorization for this shall be obtained from the Industrial Hygienist in writing prior to start of construction.
   1. Maintain floor of changing room dry and clean at all times. Do not allow overflow water from shower to wet floor in Changing Room.
   2. Damp wipe all surfaces twice after each shift change with a disinfectant solution.
   3. Provide a continuously adequate supply of disposable bath towels.
   4. Provide posted information for all emergency phone numbers and procedures.
   5. Provide one storage locker per employee.
   6. Provide all other components indicated on the Contract drawings.

F. Provide a completely water tight operational shower to be used for transit by cleanly dressed workers heading for the work area from the changing room, or for showering by workers headed out of the Work Area after undressing in the Equipment Room.

G. Construct room by providing a shower pan and 2 shower walls in a configuration that will cause water running down walls to drip into pan. Install a freely draining wooden floor in shower pan at elevation of top of pan.
   1. Separate this room from the rest of the building with airtight walls fabricated of 6-mil polyethylene.
   2. Separate this room from the Clean and Equipment Rooms with airtight walls fabricated of 6-mil polyethylene.
   3. Provide showerhead and controls.

4. Provide temporary extensions of existing hot and cold water and drainage, as necessary for a complete and operable shower.
5. Provide a soap dish and a continuously adequate supply of soap and maintain in sanitary condition.
6. Arrange so that water from showering does not splash into the Clean or Equipment Rooms.
7. Arrange water shut off and drain pump operation controls so that a single individual can shower without assistance from either inside or outside of the work area.
8. Provide flexible hose shower head.
9. Pump wastewater to drain and provide 20 micron and 5-micron wastewater filters in line to drain or waste water storage. Locate filter hose inside shower unit so that water lost during filter changes is caught by shower pan and pumped to exterior filtering system.

H. Provide equipment room for contaminated area; work equipment, footwear and additional contaminated work clothing are to be left here. This is a change and transit area for workers. Separate this room from the work area by a 6-mil polyethylene flap doorway.
   1. Separate this room from the rest of the building with airtight walls fabricated of 6-mil polyethylene.
   2. Separate this room from the Shower Room and work area with airtight walls fabricated of 6-mil polyethylene.

I. Separate work area from the equipment Room by polyethylene barriers. If the airborne asbestos level in the work area is expected to be high, add an intermediate cleaning space between the Equipment room and the work area. Damp wipes clean all surfaces after each shift change.

2.05 EQUIPMENT DECONTAMINATION UNITS

A. In areas with only one access, it may be impossible to utilize a separate Equipment Decontamination Unit. In this case, all equipment and waste materials will exit through the Personnel Decontamination Chambers.

B. When two accesses to the work area are available, provide an Equipment Decontamination Unit consisting of a serial arrangement of rooms, Clean Room, Holding Room, Wash Room for removal of equipment and material from work area. Do not allow personnel to enter or exit work area through Equipment Decontamination Unit.

C. Provide an enclosed shower unit located in work area just outside Wash Room as an equipment, bag, and container cleaning station.

D. Provide Wash Room for cleaning of bagged or containered asbestos containing waste materials passed from the work area. Construct Wash Room of 2 by 4-inch (minimum) wood framing and polyethylene sheeting, at least 6-mil in thickness and located so that packaged materials, after being wiped clean can be passed to the Holding Room. Separate this room from the work area by flaps of 6-mil polyethylene sheeting, or rigid self-closing doors.

E. Provide Holding Room as a drop location for bagged ACM passed from the Wash Room. Construct Holding Room of 2 by 4-inch (minimum) wood framing and polyethylene sheeting, at least 6-mil in thickness and located so that bagged materials cannot be passed from the Wash Room through the Holding Room to the Clean Room.

F. Provide Clean Room to isolate the Holding Room from the building exterior. Construct Clean Room of 2 by 4-inch (minimum) wood framing and polyethylene sheeting, at least 6-mil in thickness and locate to provide access to the Holding Room from the building exterior. Separate this room from the exterior by flaps of 6 mil polyethylene sheeting, or rigid self-closing doors.

PART 3 - EXECUTION

3.01 SCOPE OF WORK

It is anticipated that the asbestos abatement project will be performed in several phases in accordance with the sequential nature of selective interior demolition work. It is the Asbestos Subcontractor's responsibility to comply with the sequencing needs of the General Contractor and with commencement and completion dates to be allocated. Changing, decreasing, and increasing of phases, size, location, and scope of work shall not constitute compensation by the Owner or any of his representatives.

The Project Monitor(s) will record on a daily basis all quantities removed. The Asbestos Subcontractor will be required to do the same. Both the Subcontractor and the Monitor must sign all daily logs. No work will continue until all logs are signed daily. At the completion of the total project, if the quantities removed are found to be less than those listed below, the Asbestos Subcontractor will be required to issue a credit to the Owner based on Unit Prices or will be paid at the Unit Prices if the quantities removed are found to be greater than those listed below.

Location	Type of ACM	Approximate Quantities
1848 Wing	Ceiling Plaster	1,900 SF
Various Locations	Hidden Pipe and Hard Joint Insulation	200 LF
	Ceilings/Wall Demolition to Access ACM	2,500 SF
Basement Furnace Room	Paper on Ducts	100 SF
Basement Kitchen	Multiple Layers of Flooring	80 SF
Exterior	Windows	25 Total

Specific Notes:

1. It is the Asbestos Subcontractor's responsibility to inspect the site and confirm condition and quantities prior to the submission of his/her bid package. It is also the Asbestos Subcontractor's responsibility to review the demolition drawings, notes and phasing configurations. The Subcontractor must include in his/her bid the entire scope of work listed above. The Subcontractor must agree and accept all Unit Prices listed at the end of this section. Means and methods of removal will be at the discretion of the Subcontractor with prior approval. All work in this section shall be performed by the Asbestos Subcontractor at no additional cost to the Owner.
2. In all areas where ACM pipe and hard joint insulation has to be removed, ACM debris is included in the scope of work and has to be removed and disposed of as ACM at no extra cost to the Owner.
3. Remove and dispose as ACM of all ACM pipe and hard joint insulation found in the building and ACM that might be found in concealed and hidden locations including all ACM debris that might be found.
4. The Subcontractor shall make spot demolition in walls, vertical soffits, and other related wall structures to access ACM found behind walls. ACM debris was found. Therefore, wall demolition must be performed under containment (Walls and Ceilings Demolition to access ACM).
5. The Subcontractor shall make spot demolition in ceilings including but not limited to ceiling tiles, grids, plaster, and other related structures to access ACM found above ceilings. ACM debris was found on top of the ceiling. Therefore, ceiling demolition must be performed under containment (Walls and Ceilings Demolition to access ACM).
6. Remove and dispose as ACM of the ceiling plaster and all related attachment. Remove, decontaminate, and dispose of mounted fixtures.
7. Remove and dispose as ACM of the paper on duct. Lower the ducts to access the ACM.
8. Remove and dispose as AC of all flooring in the basement kitchen including but not limited t plywood, hardwood, floor tile, etc.

9. Remove and properly dispose of all windows, curtain walls system, including but not limited to screens, windows, doors, metal panels, glass, glass blocks, frames, sash, casings, sills, louvers, unit vents grille, shims, fasteners, anchors, sealant, flashing, etc. Caulking was found to contain asbestos and assumed to contain >1ppm of PCB's.

3.02 JOB CONDITIONS

A. Do not commence asbestos abatement work until:
   l. Arrangements have been made for disposal of waste at an acceptable site. Submittal shall be made no later than the Document Submission Date.
   2. Arrangements have been made for containing and disposal of wastewater resulting from wet stripping or filtering through a 5-micron filter.

B. All materials resulting from abatement work, except as specified otherwise shall become the property of the Asbestos Subcontractor and shall be disposed of as specified herein.

C. Pre-clean all areas prior to commencement of any work.

D. Clean all routes used to transport waste.

3.03 INSPECTION AND PREPARATION

A. Examine the areas and conditions under which asbestos will be abated and notify the Industrial Hygienist in writing of conditions detrimental to the proper and timely completion of the work.

B. Before any work commences, post danger signs in and around the Work Area to comply with 29 CFR 1926.1101 (k)(l) per federal and state regulations.

3.04 WORK PROCEDURE

A. Perform asbestos related work in accordance with 29CFR 1926.1101 and as specified herein. Use wet removal procedures. Personnel shall wear and utilize protective clothing and equipment as specified herein. Personnel of other trades not engaged in the removal and demolition of asbestos shall not be exposed at any time to airborne concentrations of asbestos unless all the personnel protection provisions of this specification are complied with by the trade personnel. Provide and post, in the Equipment Room and the Clean Room, the decontamination and work procedures to be followed by workers, as described hereinafter.

B. Each worker and authorized visitor shall, upon entering the job site, remove street clothes in the Clean Change Room and put on a respirator and clean protective clothing before entering the equipment room or the work area. All workers shall remove gross contamination before leaving the work area. All clothing such as coveralls, head covers, boots shall be removed and properly disposed of before leaving equipment room. With the exception of bathing suites and respirators, the workers shall proceed to the Shower Room. Under the shower, respirators shall be removed and cleaned. Cleaned respirators shall be placed in suitable clean plastic bags and carried by employees to Clean Room. Soap, towels shall be furnished by the Asbestos Subcontractor. The Asbestos Subcontractor shall maintain proper sanitary conditions. The Asbestos Subcontractor's designated competent person shall insure that these practices are being adhered to.

C. Following showering and drying off, each worker and authorized visitor shall dispose of towels as contaminated waste and proceed directly to the Clean Change Room and dress in clean clothes at the end of each day's work, or before eating, smoking, or drinking. Before re-entering the work area from the Clean Change Room, each worker and authorized visitor shall put on the applicable respirator and shall dress in clean protective clothing. Contaminated work footwear shall be stored in the equipment room when not in use in the work area. Upon completion of asbestos abatement, dispose of footwear as contaminated waste.

D. Contaminated work footwear shall be stored in the equipment room when not in use in the work area. Upon completion of asbestos abatement, dispose of footwear as contaminated waste or double bag for use at next site.

E. Workers removing waste containers from the Equipment Decontamination Enclosure shall enter the holding area from outside wearing a respirator and dressed in clean coveralls. No worker shall use this system as a means to leave or enter the washroom or the work area.

F. Workers shall be fully protected with respirators and protective clothing immediately prior to the first disturbance of asbestos containing or contaminated materials and until final cleanup is completed. This includes the removal of any equipment in contact with ACM such as lights, HVAC grills and other related structures.

3.05 PREPARATION OF THE WORK AREA

A. Seal off the work area by sealing large openings such as open doors, elevator doors, and passageways with a critical barrier. The critical barrier shall constitute the outermost boundary of the asbestos abatement project work area. Plastic sheeting on open framing is not a suitable critical barrier. Critical barriers may be erected of a suitable solid construction material such as plywood, sheetrock, gypsum board, or other related materials.

B. Prior to any asbestos abatement work, clean the proposed work areas using HEPA filtered vacuum equipment and wet cleaning methods as appropriate. Methods that raise dust, such as dry seeping or vacuuming with equipment not equipped with HEPA filters will not be permitted. Dispose of all cloths, which are used for cleaning as contaminated waste.

C. Place all tools, scaffolding and staging necessary for the work in the area to be isolated prior to erection of plastic sheeting temporary enclosure.

D. Shut down electric power. Provide temporary power and lighting and ensure safe installation of temporary power sources and equipment per applicable electrical code requirements. Provide 24-volt safety lighting and provide ground-fault interrupter circuits as power source for lights and electrical equipment.

E. Seal off all openings, including but not limited to corridors, doorways, windows, skylights, ducts, grills, diffusers, and any other penetrations of the work areas, with 6-mil plastic sheeting and sealed with tape.

F. Prior to any abatement activities seal all floor and ceiling openings or penetrations that have not already been sealed. This includes penetrations through ceiling and floor slabs, both empty holes and holes accommodating items such as cables, pipes, ducts, conduit and expansion joints in floors and wall and floor slab assemblies.

G. Use combination fire stop foam and fire stop sealant equivalent to Dow Corning Fire Stop Foam and Dow Corning Fire Stop Sealant. Material shall be applied in accordance with manufacturer's recommendations.

H. Maintain emergency and fire exits from the work areas, or establish alternative exits satisfactory to the local fire officials. Coordinate work with local fire and police departments, and Industrial Hygienist.

I. Shut down and isolate heating, cooling, ventilating air systems in the contaminated areas to prevent contamination and fiber dispersal to other areas of the structure. During the work, seal vents within the work area with solid barriers, such as plywood and tape and plastic sheeting, or as indicated on the drawings.

J. Remove all HVAC system filters. Pack disposable filters in sealable double 6 mil plastic bags for burial in the approved waste disposal site; replace with new filters after final cleanup. Wet clean permanent filters; reinstall after final cleanup.

K. Before work is begun, clean all items, which can be removed without disrupting the asbestos material. Pre-clean movable furniture, [carpeting, clocks, speakers, books, and other objects] within the proposed areas using HEPA filtered vacuum equipment and/or wet cleaning methods as appropriate; remove such objects from work areas to a temporary location.

L. Pre-clean non-removable furniture, book shelving, equipment, heat fans, fire alarms, pipes, ductwork, wires and conduits, lockers, skylights, speakers, and other fixed objects within the proposed work areas, using HEPA filtered vacuum equipment and wet cleaning methods as appropriate prior to abatement activities, and enclose with minimum 6 mil plastic sheeting sealed with tape.

M. Remove and clean all ceiling mounted objects, such as lights, HVAC grills and other items not previously sealed off, that interfere with asbestos abatement. Use localized water spraying or HEPA filtered vacuum equipment during fixture removal to reduce fiber dispersal.

N. The Asbestos Subcontractor will be required to supply a certified plumber to be available should any questions or problems arise.

3.06 MAINTENANCE OF ENCLOSURE SYSTEMS

A. Ensure that barriers and plastic linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery. Visually inspect enclosures at the beginning of each work period.

B. Use smoke methods to test effectiveness of barriers when directed by the Industrial Hygienist.

3.07 CONTROL ACCESS

A. Permit access to the work area only through the Decontamination Unit. All other means of access shall be closed off, warning signs displayed on the clean side of the sealed access.

B. Large openings such as open doorways and passageways shall be sealed as a critical barrier. The critical barrier shall constitute the outmost boundary of the asbestos abatement work area.

C. Plastic sheeting on open framing is not a suitable critical barrier. All cracks, seams, and openings in critical barriers shall be caulked or otherwise sealed, so as to prevent the movement of asbestos fibers out.

3.08 ISOLATION OF WORK AREA

A. Completely separate the work area from other portions of the building and the outside by sheet plastic barriers at least 6 mil in thickness.

B. Individually seal all ventilation openings (supply and exhaust), lighting fixtures, clocks, doorways, windows, convectors and speakers, and other openings into the work area with duct tape alone or with polyethylene sheeting at least 6 mil in thickness, taped securely in place with duct tape. Maintain seal until all work including work area decontamination is completed. All lighting fixtures shall have had power shut off.

C. Provide sheet plastic barriers at least 6-mil in thickness needed to complete seal openings from the work area into adjacent areas. Seal the perimeter of all sheet plastic barriers with duct tape.

3.09 COVERING OF FLOOR AND WALL SURFACES

A. Clean all contaminated furniture, equipment, and or supplies with a HEPA filtered vacuum cleaner or by wet cleaning prior to being moved or covered. All equipment, furniture, stored items in work area is to be deemed contaminated unless specifically declared as uncontaminated on the Drawings or in writing by the Industrial Hygienist. Clean all surfaces in work area with a HEPA filtered vacuum of by wet wiping prior to the installation of any sheet plastic.

B. Cover floor of work area with 2 individual layers of clear polyethylene sheeting, each at least 6 mil in thickness, turned up walls at least 12 inches. Form sharp right angle-bend at junction of floor and wall so that there is no radius, which could be stepped on causing the wall attachment to be pulled loose. Duct tape all seams in floor covering. Locate seams in top layer six feet from, or at right angles to, seams in bottom layer. Install sheeting so that top layer can be removed independently of bottom layer.

C. Remove all general construction items such as cabinets, casework, doors and window trim, moldings, ceilings, and trim which cover the surface of the work to prevent interference with the work. Clean, decontaminate and reinstall, unless otherwise indicated, all such materials, upon completion of all removal work with materials, finishes, and workmanship to match existing installations before start of work.

D. Cover all walls in work area with two (2) layers of polyethylene sheeting, at least 6- mil in thickness, mechanically supported and sealed with duct tape. Tape all joints including the joining with the floor covering with duct tape or as otherwise indicated on the Contract documents or in writing by the Industrial Hygienist. There shall be no seams in the plastic sheet at wall to floor joints.

E. If the enclosure barrier is breached in any manner that could allow the passage of asbestos debris or airborne fibers, then add affected area to the work area, enclose it and decontaminate it.

3.10 NEGATIVE PRESSURE

A. Establish negative pressure in the work area by installation of High Efficiency Particulate Air (HEPA) filter air-purifying devices. Comply with ANSI Z9.2, Local Exhaust Ventilation Requirements. Maintain system in operation 24 hours per day until decontamination of the work area is completed and area has been certified clean by air monitoring tests and visual inspections. Discharge of asbestos fibers to the outside of the building will not be permitted.

B. Size negative air pressure system(s) to provide a minimum of one air change every l5 minutes for the area under negative pressure. Locate the exhaust unit(s) so that makeup air enters the work area primarily through the decontamination unit and traverses the work area as much as possible. The intent is to provide the air change specified in each work area (room), not just the specified negative pressure. Place the end of the unit or its exhaust duct through an opening in the plastic barrier or wall covering. Seal the plastic around the unit or duct with tape.

C. The system shall maintain an air pressure differential of minus 0.02 inch of water. Test the negative pressure system prior to any abatement actions to ensure that the 0.02-inch differential is present. The Industrial Hygienist may require the use of ventilation smoke tubes to check the system performance.

3.11 REMOVAL OF ASBESTOS CONTAINING MATERIALS

A. Thoroughly wet ACM to be removed prior to stripping to reduce fiber dispersal into the air. Accomplish wetting by a fine spray (mist) of amended water or removal Encapsulant. Saturate material sufficiently to wet to the substrate without causing excess dripping. Allow time for water or removal Encapsulant to penetrate material thoroughly. If a removal Encapsulant is used, apply in strict accordance with manufacturer's written instructions.

B. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels.

C. Remove saturated ACM in small sections from all areas. Do not allow material to dry out. As it is removed, simultaneously pack material while still wet into disposal bags. Twist neck of bags, bend over and seal with minimum three wraps of duct tape. Clean outside and move to wash down station adjacent to material decontamination unit.

D For the removal of pipe and joint insulation, the density of asbestos containing pipe covering seldom allows the material to be removed in a completely wet state. However, every attempt should be made to keep the insulation material as wet as possible to prevent release of asbestos fibers.

E. Cut the cloth covering on the pipe insulation along the top seam to allow wetting of the asbestos insulation. Do not allow the pipe insulation to fall to the ground or adjacent surfaces. Wet the insulation material and immediately place in a double 6 mil, minimum thickness labeled plastic bag.

F. In certain areas, asbestos pipe insulation will be removed with glove-bags (with prior approval by the Industrial Hygienist).

1. Seal all critical barriers.
2. Pre-clean if necessary and place one layer of polyethylene under the pipe to be removed.
3. Negative air machines with HEPA filtration will be used in the area.
4. Glove bags will be smoke tested.
5. Place necessary tools into pouch located inside glove-bag. This will usually include bone saw, utility knife, rags, scrub brush, wire cutters, tin snips, and pre-wetted cloth.
6. Place one strip of duct tape along the edge of the open top slit of glove-bag for reinforcement.
7. Place the glove bag around section of pipe to be worked on and staple top together through reinforcing duct tape. Next, duct tape the ends of glove-bag to pipe itself, where previously covered with plastic or duct tape.
8. Place additional layers of tape along the top of the glove-bag to seal the staple holes and to securely support the bag on the pipe.
9. Fill each bag with 2 inches of water to thoroughly wet the removed insulation.
10. Attach vacuum hose through port in bag and tape tightly to prevent leakage.
11. Insert spray nozzle into bag and tape tightly to prevent leakage.
12. One person places his hands into the long-sleeved gloves while the second person directs garden sprayer at the work.
13. Use bone saw, if required, to cut insulation at each end of the section to be removed. A bone saw is a serrated heavy gauge wire with ring-type handles at each end. Throughout this process, spray amended water or removal Encapsulant on the cutting area to keep dust to a minimum.
14. Remove insulation using putty knives or other tools. Place pieces in bottom of bag without dropping.
15. Using nylon scrub brush, rags, and water scrub and wipe down the exposed pipe.
16. Wipe down the inside of the bag with the rags. Remove the water nozzle and tape shut.
17. Encapsulate the exposed ends and cover any exposed ends of pipe insulation with the re-wettable clothe. This shall be done prior to removing the bag.
18. Place the cleaned tools either into the next glove bag or put into the glove and pulled out. Twist the glove, tape at least twice and cut through the tape. The tools can be dropped into a bucket of water to clean them.
19. Twist the bag several times and turn on HEPA vacuum to remove the air. Tape the twist several times.
20. Slip a 6-mil disposal bag under the glove-bag and while running the vacuum sufficiently to collapse the bag, cut the glove-bag off.
21. Encapsulate all exposed pipe and elbows to lock down any remaining fibers.
22. Remove disposable suits and place these into bag with waste.
23. Collapse the disposal bag with a HEPA vacuum, twist top of bag, seal with at least 3 wraps of duct tape, bend over and seal again with at least 3 wraps of duct tape.

3.12 DECONTAMINATION OF WORK AREA

A. Maintain premises and public properties free from accumulation of waste, debris, and rubbish, caused by operations. Remove visible accumulations of asbestos material and debris. Wet clean all surfaces within the work area.

B. Remove the plastic sheets from walls and floors only. Take proper care in folding up plastic sheeting to minimize dispersal of residual asbestos containing debris.

C. Leave the windows, doors, and HVAC vents sealed. Maintain HEPA filtered negative air pressure systems, air filtration and decontamination enclosure systems in service.

D. Remove all debris from floor of work area. This includes all trash, scraps of lumber, pipes, and all visible asbestos debris. The asbestos debris is primarily deteriorated pipe insulation that has fallen to the ground. Dispose of all debris removed as asbestos contaminated waste. HEPA vacuum the entire floor.

E. Clean all surfaces in the work area and any other contaminated areas with water and with HEPA filtered vacuum equipment. After cleaning the work area, wait 24 hours to allow for settlement of dust, and again wet clean and clean with HEPA filtered vacuum equipment all surfaces in the work area. After completion of the second cleaning operation, perform a complete visual inspection of the work area to ensure that the work area is free of visible asbestos debris. The negative pressure system may be shut down only after clean air has been achieved.

F. Include sealed drums and all equipment used in the work area in the cleanup and remove from work areas, via the equipment decontamination enclosure system, at an appropriate time in the clean sequence.

G. Conduct cleaning and disposal operations to comply with applicable ordinances and antipollution laws. Do not burn or bury rubbish and waste materials on job site. Do not dispose of volatile wastes in storm or sanitary drains. Do not dispose of wastes into streams or waterways.

H. Store volatile wastes in covered metal containers during work hours and remove from premises at end of workday. Prevent accumulation of wastes, which create hazardous conditions. Provide adequate ventilation during use of volatile or noxious substances.

I. If the Industrial Hygienist, within 24 hours after the second cleaning, finds visible accumulations of asbestos debris in the work area, repeat the wet cleaning until the work area is in compliance, at no additional expense to the Owner.

J. Remove the first layer of plastic sheet from walls and floors only. Take proper care in folding up plastic sheeting to minimize dispersal of residual asbestos containing debris.

K. Leave the windows, doors, and HVAC vents sealed. Maintain HEPA filtered negative air pressure systems, air filtration and decontamination enclosure systems in service.

L. Following the final visual inspection by the IH, after the removal of asbestos-containing materials and decontamination of work areas, and while space enclosures systems remain in place, seal all surfaces from which asbestos-containing material have been removed to assure immobilization of any remaining fibers. Use a colored sealant so that complete coverage may be ensured by a visible inspection by the IH to verify that asbestos-containing material has been adequately removed. Apply sealer in accordance with manufacturer's recommendations using airless spray equipment.

M. Clearance air samples will be taken by the IH using aggressive air sampling. Analysis will be made using Phase Contrast Microscopy or Transmission Electron Microscopy.

N. Clean all access routes used to transport ACM.

3.13 WORK AREA CLEARANCE

A. The work is complete when the work area is visually clean and airborne fiber levels have been reduced to the level specified below. When this has occurred, the Asbestos Subcontractor will notify the Industrial Hygienist that the area is ready for clearance.

B. The number and volume of air samples taken, and analytical methods used by the Industrial Hygienist will be in accordance with applicable regulations.

C. **The Owner will pay for the initial testing required for clearance. Should the initial testing fail, the Subcontractor will reimburse the Owner for the cost of all additional testing based on $90.00 per hour for project monitor, $30.00 per each PCM.**

3.14 DISPOSAL OF ACM AND ASBESTOS CONTAMINATED WASTE

A. To prevent exceeding available storage capacity on site, remove sealed and labeled containers of asbestos waste and dispose of such containers at an authorized disposal site in accordance with the requirements of disposal authority.

B. Comply with 29 CFR 1926.1101.

C. Seal all asbestos and asbestos contaminated waste material with double thickness 6-mil, sealable plastic bags. Label the bags; transport and dispose of all in accordance with the applicable OSHA and EPA regulations. At the conclusion of the job, place all polyethylene material, tape, cleaning material and clothing in the plastic lined drum. Seal, correctly label, and dispose of as asbestos waste material.

D. Transport the bags to the approved waste disposal site. Asbestos Subcontractor shall obtain trip tickets at the landfill to document disposal of asbestos containing materials. A form shall be signed, not initialed, by all parties. Copies of all trip tickets shall be submitted to the Industrial Hygienist.

E. If a rental vehicle is used to transport asbestos waste, Asbestos Subcontractor shall provide to the vehicle's owner a written statement as to the intended use of the vehicle. A copy of such notice, signed by the vehicle owner, shall be provided to the Industrial Hygienist prior to transporting materials in the vehicle. Two layers of 6-mil plastic sheet shall be placed on the floor and walls of the rental vehicle prior to loading any containers of asbestos waste.

F. Consider wastewater from showers and sinks to be contaminated waste and dispose of in accordance with this Section unless water has been filtered through a 5-micron filter.

3.15 DISPOSAL OF NON-CONTAMINATED WASTE

A. Remove from the site all non-contaminated debris and rubbish resulting from demolition operations. Transport materials removed from demolished areas and dispose of off-site in a legal manner.

B. During progress of work, clean site, and public properties, and dispose of waste materials, debris, and rubbish. Provide on-site containers for collection of waste materials, debris, and rubbish. Remove waste materials, debris, and rubbish from site and legally dispose of at public or private dumping areas off Owner's property.

3.16 ALTERNATE CONTAINMENT SYSTEM

A. In lieu of the containment system previously described consisting of a decontamination enclosure system utilizing curtained doorway, and a negative air system to exhaust sufficient air to achieve one air change every 15 minutes, the following system will be allowed.

B. Construct a decontamination unit consisting of a totally enclosed Equipment Room, Shower Room, Air Locks, and Clean Room as described above except that instead of curtained doorways between rooms, doorways shall be solid core rigid wooden or fiberglass doors. Door at entrance into Clean Room from the uncontaminated area shall contain a HEPA filter. This doorway shall have gasketed seals around the HEPA filter and the edges of the door to provide a tight seal. HEPA filter shall be mounted in the door securely using a mechanical fastening system. Each door shall be equipped with a self-closing mechanism.

C. Negative pressure units as described previously shall be utilized to create a pressure differential of 0.02 inches of water between the work area and the outside uncontaminated area. Only the required air volume to create the negative pressure shall be exhausted through the HEPA filter unit outside the work area. Additional HEPA filter units shall be located within the work area to provide for air circulation.

3.19 UNIT PRICES

A. All quantities listed in 3.01 are approximate. It is the Asbestos Subcontractor's responsibility to inspect the site and confirm condition and quantities prior to the submission of his/her bid package. It is also the Asbestos Subcontractor's responsibility to review the demolition drawings, notes and phasing configurations.

B. The Subcontractor must include in his/her bid the entire scope of work listed in 3.01. The Subcontractor must agree and accept all unit prices listed below. Means and methods of removal will be at the discretion of the Subcontractor with prior approval by the on-site Monitor and Designer.

C. Units prices listed below are inclusive of all related costs.

	ADD	DEDUCT
1. Flooring Material	$ 5.00 per SF	$ 4.50 per SF
2. Rough Plaster	$ 7.50 per SF	$ 6.50 per SF
3. Pipe Insulation	$ 25.00 per LF	$ 20.00 per LF
4. Hard Joint Insulation	$ 25.00 each	$ 20.00 each

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to Division 00 and Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.

B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials, and equipment necessary to complete the Work of this Section, including but not limited to the following:
   1. Concrete footings for steel columns
   2. Concrete slab, including thickened areas below bearing partitions above
   3. Concrete footing and walls for new LU/LA elevator pit
   4. Exterior stairs and walkways per landscape drawings
   5. Housekeeping pads

B. Work specified elsewhere: masonry subcontractor shall provide concrete cap at reconstructed stone retaining wall.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this Section. Other Sections that relate directly to work of this Section include, but are not limited to the following:
   1. Section 01 22 00 Unit Prices
   2. Section 01 45 23 Testing and Inspecting Services
   3. Section 04 43 00 Stone Masonry
   4. Section 05 12 23 Structural Steel for Buildings
   5. Section 06 10 00 Rough Carpentry
   6. Section 07 26 16 Below-Grade Vapor Retarders

1.04 REFERENCES

A. ACI 301 - Structural Concrete for Buildings
B. ACI 302 - Guide for Concrete Floor and Slab Construction
C. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete
D. ACI 305R - Hot Weather Concreting
E. ACI 306R - Cold Weather Concreting
F. ACI 308 - Standard Practice for Curing Concrete
G. ACI 318 - Building Code Requirements for Reinforced Concrete
H. ANSI/ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
I. ASTM C33 - Concrete Aggregates
J. ASTM C94 - Ready-Mixed Concrete
K. ASTM C150 - Portland Cement
L. ASTM C260 - Air Entraining Admixtures for Concrete
M. ASTM C494 - Chemicals Admixtures for Concrete
N. ACI SP-66 - American Concrete Institute Detailing Manual
O. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement
P. CRSI - Concrete Reinforcing Steel Institute Manual of Practice

Q. CRSI - Placing Reinforcing Bars

1.05 SUBMITTALS

A. Product Data: Provide product data for all accessories, admixtures, and inserts.

B. Shop Drawings: Fully show all bar sizes, spacing, locations, and quantities of reinforcing steel and wire fabric. Provide bending and cutting schedules.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. Conform to ACI 305R when concreting during hot weather.

C. Conform to ACI 306R when concreting during cold weather.

D. Detailing and construction of formwork, shoring and bracing shall be sufficient to maintain required alignments and surfaces. All work shall conform to ACI 318 and ACI 301, the Commonwealth of Massachusetts State Building Code, and accepted construction practice.

E. Reinforcing steel detailing and installation shall be in accordance with CRSI *Manual of Standard Practice*, ACI SP-66, and ACI 318

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. ConProCo, 17 Production Dr., Dover, NH 03820; 800-258-3500; www.conproco.com.

B. Quikcrete, 3490 Piedmont Rd. suite 1300, Atlanta, GA 30305; 800-282-5828; www.quikrete.com.

C. Hilti, Inc., 5400 S. 122nd East Ave., Tulsa, OK 74146; 800-879-8000; www.us.hilti.com.

D. Sika Corp., 201 Polito Ave., Lyndhurst, NJ 07071; 800-933-7452; www.sikacorp.com.

E. Euclid Chemical, 19218 Redwood Road, Cleveland, OH 44110, 800-321-7628; www.euclidchemical.com

2.02 CONCRETE MATERIALS

A. Portland Cement: ASTM C150

B. Fine and Coarse Aggregates: ASTM C33

C. Water: Clean and not detrimental to concrete

2.03 ADMIXTURES

A. Air Entraining admixture: ASTM C260

B. Chemical: ASTM C494 Type A - Water Reducing

C. No admixtures shall contain calcium chloride

D. Accelerating admixture: Polarset

2.04 CONCRETE ACCESSORIES

A. Vapor Barrier: see Section 07 26 16 - Below-Grade Vapor Retarders.

B. Do not use curing compounds on concrete floor slabs.

2.05 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler: ASTM D1752: Closed cell polyvinyl chloride or molded vinyl foam, resiliency recovery of 95 percent if not compressed more than 50 percent of original thickness.

B. Sealant and Primer: As specified in Section 07 92 00

2.06 REINFORCEMENT AND ACCESSORIES

A. Reinforcing Steel: ASTM A615, 60-ksi yield grade; deformed billet steel bars, unfinished

B. Welded Steel Wire Fabric: ASTM A185; in flat sheets; unfinished

C. Tie Wire: Minimum 16 gage annealed type

D. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture.

E. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type; size and shape as required.

F. Fabricate reinforcing in accordance with CRSI Manual of Practice, ACI SP-66, ACI 318.

G. Provide sheet vapor barrier below slabs as specified in Section 07 26 16 - Below-Grade Vapor Retarders.

2.07 CONCRETE MIX

A. Standards: Mix concrete in accordance with ACI 304. Deliver concrete in accordance with ASTM C94. Select proportions for normal weight concrete in accordance with ACI 301 Method 1.

B. Concrete and Topping Requirements:
   1. Cast in Place Concrete shall have the following properties:

Compressive Strength (28-day)	4,000 psi
Water/Cement Ratio (maximum)	0.40 by weight outdoors, 0.45 indoors
Aggregate Size	¾” maximum
Air Entrainment	4% to 6%
Water-Reducing Agent	As required
Slump	To suit placement
Calcium Nitrate Corrosion Inhibitor	2.5 gal./cu. yd. at exterior pads/slabs

   2. Use accelerating admixtures in cold weather when approved by the Architect but do not relax other cold weather concrete placement requirements.
   3. Do not use admixtures containing calcium chloride.
   4. Add air-entraining agent to normal weight concrete mix for work exposed to exterior.

2.08 FORM MATERIALS AND ACCESSORIES

A. Plywood: Douglas Fir or Spruce species; sheathing grade; clean, smooth sheets with true edges.

B. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

C. Corners: Chamfer, rigid plastic, or wood strip type, 3/4" x 3/4", maximum possible lengths.

2.09 SODIUM SILICATE DENSIFIER

A. Euclid Eucosil or approved equal (Sonneborn Sonosil, Scofield Formula One SG)

B. HyraCure S16 single-use wet curing cover or approved equal

PART 3 - EXECUTION

3.01 PREPARATION OF EXISTING CONCRETE OR MASONRY FOR NEW CONCRETE PLACEMENT

A. Bonding: Prepare previously placed concrete by roughening to an amplitude of greater than ¼" and cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

B. Doweling: In locations where new concrete is dowelled to existing concrete or stone masonry, obtain the embedments noted on the drawings. Epoxy Adhesive for doweling shall be equivalent to the Hilti Hit "HY200" Epoxy Injection system for doweling into concrete and the Hilti Hit "HY270" Epoxy Injection System with screen tubes for doweling into masonry. Drill bit diameters and procedures shall be per manufacturer's instructions.

3.02 ERECTION OF FORMWORK FOR NEW CONCRETE PLACEMENT

A. Hand trim sides and bottom of earth forms where used. Remove loose soil and machine compact prior to placing concrete.

B. Erect formwork, shoring and bracing in accordance with ACI 301 to achieve required geometry and stability. Provide for proper support of concrete’s fluid weight plus temporary construction load where can be applied.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Align joints and make watertight. Keep form joints to a minimum. Provide chamfer strips on external corners of foundation walls. Maintain tolerances required by ACI 301.

D. Apply form release agent on formwork in accordance with manufacturer's recommendations. Do not apply form release agent where concrete surfaces will receive applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

E. Clean forms as erection proceeds and clean formed cavities of debris prior to placing concrete. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports. Do not allow ice or snow to accumulate within forms, but remove manually if this accumulates. Do not use de-icing salts and do not use water to clean out forms in cold weather conditions. Use compressed air or other means to remove foreign matter.

F. Do not reuse wood formwork more than 2 times for concrete surfaces that will be exposed to view.

3.03 PLACEMENT OF REINFORCING STEEL

A. Place, support, and secure reinforcement against displacement. Do not deviate from required position. Do not displace or damage vapor barrier where present. Accommodate placement of formed openings and inserts.

B. Field inspection of reinforcing steel will be performed by an independent testing agency hired by the owner and per the Commonwealth of Massachusetts State Building Code. Notify Architect at least 36 hours in advance of completion of reinforcing steel installation. Do not place concrete until reinforcing steel has been inspected and approved by the Architect.

C. See Subsection 3.01 of this Section for installation of reinforcing steel dowels into existing construction.

3.04 INSERTS, EMBEDDED PARTS, OPENINGS, AND ACCESSORIES FOR NEW CONCRETE

A. Provide formed openings where required for items to be embedded in passing through concrete work. Locate and set in place items that will be cast directly into concrete. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

B. Install accessories in accordance with manufacturer's instructions, straight, level, and plumb. Ensure items are not disturbed during concrete placement.

C. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

D. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

E. Install vapor barrier under interior slabs on grade. Lap joints minimum 6 inches and seal watertight by taping edges and ends. Repair vapor barrier damaged during placement of concrete reinforcing. Repair with vapor barrier material; lap over damaged areas minimum 6 inches and seal watertight.

F. Separate slabs on grade from vertical surfaces and new concrete from existing with ½-inch thick joint filler except where dowels are installed between the two to rigidly lock and bond the old and the new together. Place joint filler along floor slab edge. Set top to required elevations. Secure to resist movement by wet concrete. Extend joint filler from bottom of slab to within ¼ inch of finished slab surface.

3.05 CONCRETE PLACEMENT

A. Place concrete in accordance with ACI 304 or ACI 301. Notify Architect minimum 72 hours prior to commencement of operations.

B. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, and waterstops are not disturbed during concrete placement.

C. Maintain records of concrete placement: Record date, location, quantity, air temperature, and test samples taken.

D. Place concrete continuously between predetermined expansion, control, and construction joints. Do not interrupt successive placement; do not permit cold joints to occur. Screed and steel trowel interior slabs on grade level, maintaining surface flatness of maximum ¼ inch in 10 ft.

3.06 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

B. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

C. Following removal of formwork, coat all formed subgrade surfaces with one coat of bituminous damp proofing.

3.07 CONCRETE FINISHING, CURING, AND PROTECTION

A. Provide formed concrete surfaces to be left exposed concrete walls with smooth rubbed finish.

B. Finish concrete floor surfaces in accordance with ACI 301.
   1. Interior slabs shall have machined steel trowel finish.
   2. Housekeeping pads and slabs that shall receive bonded fluid applied or sheet membrane waterproofing shall have a steel trowel finish.
   3. Slabs (such as housekeeping pad areas) that shall be topped with other concrete or mortar shall be intentionally roughened for bond (see 3.01 of this Section).

C. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

D. Cure floor surfaces in accordance with ACI 308, maintaining 100 percent coverage of water over floor slab areas continuously for 4 days. Spray water over floor slab areas and maintain wet for 7 days.

E. In utility areas, apply a sodium silicate densifier two weeks after curing. To assure wet curing in this area, keep moist as noted above or use membrane applied curing compound per manufacturer’s instructions.

3.08 FIELD INSPECTION AND TESTING

A. Field Inspection and Testing: Field inspection and testing will be performed in accordance with ACI 301 and the Commonwealth of Massachusetts State Building Code. The contractor shall pay for all sampling and laboratory testing.

B. Mix Design Submission: Submit proposed mix design to inspection and testing firm for review prior to commencement of work. Provide four copies to the Architect.

C. Cement and Aggregates: Tests of cement and aggregates may be performed to ensure conformance with specified requirements.

D. Test Cylinders: Three concrete test cylinders will be taken for each day's batch.

E. One additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.

F. One slump test will be taken for each set of test cylinders taken.

END OF SECTION

SECTION 04 43 00 – STONE MASONRY

PART 1 - GENERAL

1.01 FILED SUB-BID

A. MASONRY WORK is stipulated as a filed sub-bid under Part D, Item 2 of the General Bid Form in Section 00 41 13

B. All sub-bids shall be submitted on the "Form of Sub-Bid" furnished by the Awarding Authority and contained in Section 00 41 13. Sub-bids shall be submitted in accordance with the provisions of Massachusetts General Laws, Chapter 149, Sections 44A-J inclusive.

C. Sub-bids must be filed with the Awarding Authority in a sealed envelope before the local time and the date stipulated in the "Advertisement for Bids" in Section 00 11 13.

D. Specified information relating to sub-bidders is set forth in the Contract Documents under the heading "Instructions to Bidders", in Section 00 21 13 and attention is directed thereto.

E. The Work of this Section is shown on the following Drawings:

1. Inclusive of all Drawings listed on Drawing A-00 "Project Information" and in Section 00 01 15 "List of Drawing Sheets" in Division 00 of the Project Manual.

1.02 GENERAL PROVISIONS

A. Attention is directed to Division 00 and Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.

B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.03 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not limited to the following:

1. Dismantling and reconstructing designated portion of the stone retaining wall along the west alley.
2. Cutting and pointing of:
   a. Stone granite masonry foundation wall (exposed portions from wood sill to 12" (minimum) below grade)
   b. Stone granite masonry foundation wall (full height of portion that becomes exposed during the stone retaining wall reconstruction)
   c. Stone retaining wall along Great Road (portions that are not being reconstructed)
3. Concrete cap at reconstructed stone retaining wall, see Section 03 30 00 – Cast-in-Place Concrete.

1.04 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this Section. Other Sections that relate directly to work of this Section include, but are not limited to the following:

1. Section 02 44 00 – Shoring, Bracing & Support
2. Section 03 30 00 – Cast-in-Place Concrete
3. Section 06 10 00 – Rough Carpentry

1.05 REFERENCES

A. ASTM C33 – Concrete Aggregates

B. ASTM C141 – Hydrated Hydraulic Lime

C. ASTM C144 – Sand for Mortar and Grout

D. ASTM C270 – Mortar and Mortar Testing for Unit Masonry

E. ACI 530 – Building Code Requirements for Masonry Structures

F. ACI 530.1 – Specifications for Masonry Structures

G. IMIAC – International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Cold Weather Masonry Construction

1.06 SUBMITTALS

A. Mortar mix designs and/or product submittals for pre-packaged mortars

B. Bonding agents

C. Product Samples: Provide samples for all mortar types. Mortar samples shall be 12” long bars of same width as joints.

D. Field-Constructed Mock-Ups: Prior to start of general masonry restoration, prepare repointing sample panels and cleaning sample panels in each building area where differing mortar or detailing exists, as directed by Architect. Notify Owner and Architect at least one week prior to beginning of work, so that they may be present. Obtain Architect's approval of visual qualities before proceeding with further work. Allow sufficient time for this review process. No additional work shall be performed without approval of field samples. Retain acceptable panels in undisturbed condition, suitably marked, during construction as a standard for judging completed work.

E. Work that does not match the approved sample panels shall be rejected and redone. The contractor shall be responsible for producing as many sample panels as necessary to provide a match of existing adjacent work that meets the satisfaction of the Arhcitect.

F. Sample of new stone as required to increase elevation of existing stone retaining wall to be reconstructed

G. Filter fabric

H. Geogrid

1.07 QUALITY CONTROL

A. Comply with all referenced standards for the products employed.

B. Comply with requirements of Massachusetts State Building Code.

C. Coordinate times of Special Inspections to comply with Massachusetts State Building Code.

D. All masonry work shall be performed by individuals with more than ten years of well-referenced experience with similar projects.

E. During periods of cold or questionable weather, keep a log of work including air temperature and weather conditions, work started and completed per day, and tests taken. No work shall be done when the ambient temperature of the structure or the air is less than 45 degrees F.

F. Produce mortar and grout samples in the form of 2" x 2” x 2” flat slabs, placed against wooden side forms and backing, for easy removal of cured sample. Provide 8 samples per mortar and grout type taken on different days and cured under conditions that match field conditions to testing laboratory for compression testing. Provide at least four 2" x 2" x 2" field cut samples of existing mortar to the testing laboratory for comparative compression testing. Contractor shall arrange for and pay for all testing and shall submit results at 7 days and at 28 days to the Engineer. Adjustments in mix and re-tests shall be made as required at no additional cost to the owner. Test existing mortar samples and trial mixes at least three weeks before commencing masonry work.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site in manufacturer's original and unopened containers and packaging, bearing labels as to type and names of products and manufacturers.

B. Protect mortar and other cementitious materials from deterioration by moisture and temperature. Store in a dry location or in waterproof containers. Keep containers tightly closed and away from open flames. Protect liquid components from freezing. Comply with manufacturer's recommendations for minimum and maximum temperature requirements for storage.

C. Restore any damage to site caused by storage, mixing or construction work.

D. Packing and Loading of Materials: Carefully pack and load finished stone for shipment using all reasonable and customary precautions against damage in transit. Do not use any material that may cause staining or discoloration for blocking or packing.

E. Store cementitious materials off the ground, under cover and in dry location.

F. Store aggregates where grading and other required characteristics can be maintained.

G. Protect mortar materials and stone accessories including metal items to prevent deterioration by corrosion and accumulation of dirt.

1.09 SEQUENCING/SCHEDULING

A. Order replacement stone units (if needed) at the earliest possible date, to avoid delaying completion of the Work.

B. Use sequence that best suits the work.

1.10 PROJECT CONDITIONS

A. Do not repoint mortar joints or repair masonry unless air temperatures are between 40˚F (4˚C) and 80˚F (27˚C) and will remain so for at least 48 hours after completion of work. During periods of questionable weather keep a log of work including air temperature and weather conditions, work started and completed per day and tests taken.

B. Prevent grout or mortar used in repointing and repair work from staining face of surrounding masonry and other surfaces. Remove immediately grout and mortar in contact with exposed masonry and other surfaces.

C. Protect sills, ledges and projections from mortar droppings.

D. Protection: Protect and maintain all work in a dry safe condition for the duration of the work.

E. Protection of Work: Cover tops of walls with heavy waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover in place.
2. Staining: Prevent grout or mortar from staining the face of stone to be left exposed. Remove immediately grout or mortar in contact with such stone.
3. Protect surrounding surfaces from rain-splashed soil and mortar splatter by means of coverings spread on ground and over wall surface. Protect sills, ledges and projections from droppings of mortar.

F. Remove all masonry determined to be frozen or damaged by freezing conditions.

G. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface. Protect sills, ledges and projections from droppings of mortar.

H. Protection During Cleaning: Protect persons, motor vehicles, construction site and surrounding buildings from injury resulting from stone cleaning work.

1. Protect all non-stone surfaces. Review all protective measures with Engineer.
2. Protect all non-masonry surfaces. Review all protective measures with Architect.
3. Prevent cleaning solutions from coming into contact with pedestrians, motor vehicles, plant materials, buildings and other surfaces that could be injured by such contact.
4. Do not clean stone during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
5. Dispose of run-off from cleaning operations by legal means and in a manner which prevents soil erosion, undermining of paving and foundations, and damage to adjacent landscaping.

PART 2 - PRODUCTS

2.01 MASONRY UNITS

A. Stone: Re-used or new as needed: clean, igneous rocks that are free from cracks, cleavage planes, seams, and defects that would result in the breakdown of the rock in a exterior environment.

2.02 MORTAR AND GROUT

A. Provide the following products and formulations:
1. Mortar for setting/ re-setting of stone units & setting geogrid in reconstructed stone retaining wall: SikaQuick VOH or approved equal.
2. Mortar for re-setting or repointing of stone units shall be ASTM C270, Type N as follows: 1 part Portland Cement, 1 parts Hydrated Lime, 6 parts Bulked Sand. Mortar sand shall be blended and graded to provide a mortar that matches the existing, adjacent mortar in its clean condition. Only if necessary, provide

pigments to match the surrounding (cleaned) mortar in appearance, color and texture. Pigments shall be chemically pure mineral oxides, alkali proof and light fast, and shall be equal or equivalent to “Solomon Grind” as manufactured by Chem Services Inc, of Springfield, IL, and shall be limited to not more than 10% of binder. Replace one third of the mix water with Silpro C-21 acrylic latex bonding agent or approved equal.

2. Injection and Gravity-Feed Grout for filling cracks and voids in masonry:
   a. For cracks and spaces of minimum clear dimension of less than 1/4": 1 part Portland Cement and 3 parts Hydrated Lime slurry with up to 12 gallons of mixing water per bag of Cement. Add 0.5% Grouting Aid by weight of binder.
   b. For cracks and spaces of clear dimension between 1/4" and 2": Fine Grout with following proportions by volume: 1 part Portland Cement, 3 parts Hydrated Lime and 8 parts to 10 parts fine Sand plus water to suit application. Minimum mixing water to suit injection or gravity placement. Add 0.5% Grouting Aid by weight of binder.
   c. For spaces of minimum clear dimension of more than 2" (other than for grouted reinforced flues): Coarse Grout with following proportions by volume: 1 part Portland Cement, 3 parts Hydrated Lime and 8 parts to 10 parts fine Sand, and up to 6 parts Pea Gravel (reducing the volume of sand accordingly). Add 0.5% Grouting Aid by weight of binder.

B. Portland Cement shall meet ASTM C150, Type I low-alkali cement having a maximum of 0.60% equivalent alkalis

C. Hydrated Lime shall meet ASTM C207, Type S.

D. Coarse Aggregate for Grout: ASTM C-33, 3/8" dia. minimum gravel or stone.

E. Grouting Aid: Equal or equivalent to "Interplast-N" Expanding / Fluidifying Grouting Aid as manufactured by the Sika Corporation of Lyndhurst, NJ.

F. The contractor shall review the water content and any required adjustments along with proposed products with the Architect. Contractor shall then submit a record mortar mix design along with product data sheets to the Architect for verification, review, and approval before beginning any mixing or installation.

G. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.

H. Mix grout in accordance with ASTM C94 or thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 Fine or Course grout.

I. Do not use anti-freeze compounds to lower the freezing point of grout.

2.03 MORTAR WASHDOWN CLEANER

A. For non-pigmented mortars, use equal or equivalent to “Sure Klean 600 Detergent” as manufactured by PROSOCO Corp.

B. For pigmented mortars use equal or equivalent to “Vana Trol” as manufactured by PROSOCO Corp.

C. ReKlaim (formerly BoiKlean) neutralized with SureKlean Limestone & Masonry Afterwash per manufacturer’s instructions, or EK Restoration Cleaner, as appropriate

D. Hydroclean HT-455 or approved equal

2.04 FILTER FABRIC

A. Resistant to bilogical degradatin and naturally encountered chemicals, alkalis and acids, with the following properties:

Property	Standard	Value
Grab tensile strength	ASTM D4632	315-400# (min. range)
Grab tensile elongation	ASTM D4632	15% (max.)
Trapezoid tear strength	ASTM 4533	150-165# (min.)
CBR puncture strength	ASTM D6241	1,150# (min.)
Apparent opening size	ASTM D4751	#40 sieve/0.420 mm
Percent open area	COE-02215	1% (max.)
Permittivity	ASTM D4491	0.90 sec-1/
Flow rate	ASTM D4491	70 gal/min/ft2/
UV resistance (@500 hrs)	astm d4355	90% strength retained (min.)

2.05 GEOGRID REINFORCEMENT SYSTEMS

A. All geogrid products shall be of high density polyethylene or polyester yarns encapsulated in a protective coating specifically fabricated for use as a soil reinforcement and shall conform to the following standards:

1. ASTM D4595 – Tensile properties of geotextiles by the wide-width strip method
2. ASTM D5262 – Test method for evaluating the unconfined creep behavior of geogrids
3. ASTM D6638 – Grid connection strength (SRW-U1)
4. ASTM D6916 – SRW block shear strength (SRW-U2)
5. GRI-GG4 – Grid long term allowable design strength (LTADS)
6. ASTM D6706 – Grid pullout of soil

B. Contractor shall check the materials upon delivery to assure proper material has been received. contractor shall prevent excessive mud, cementitious material, and like construction debris from coming in contact with the geogrid materials. Contractor shall protect the materials from damage. Damaged material shall not be incorporated in the project.

C. Geogrid shall be Tencate Mirafi Miragrid 3XT, or approved equal with a minimum allowable tensile capacity of 3,500 pounds per foot and a minimum long-term design strength (LTDS) of 2,104 pounds per foot (alternate products must also have resistance to alkalis). Contractor shall provide product submittal for approval prior to geogrid purchase.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect all masonry within work areas, identify all required repairs and removals.

B. Perform all other indicated masonry work in accordance with the requirements of this section and all references.

3.02 MARKING, CUTTING AND REMOVAL OF DESIGNATED OR DAMAGED MASONRY

A. Identify the areas where existing masonry is to be removed.

B. Photograph all existing work in place before removal.

C. Provide and install all temporary shoring, bracing and support to surrounding construction before beginning removal. Where appropriate, removal and replacement shall be done sequentially to avoid weakening too much of the structure at one time. Contractor shall be solely responsible for maintaining integrity and safety of surrounding construction.

D. After identifying lines of removal, carefully remove designated masonry units, maintaining support to all surrounding and supported elements that are otherwise dependent upon the masonry being removed for support or stability. In the case of individual units that are to be re-set, limit saw cuts to joint lines in order not to damage the units.

E. Following removal of the units, inspect the remaining masonry along cut lines and remove all loose mortar or leftover broken units to expose flat, uniform surface and/or detaching each unit's anchors to the back-up construction and to the adjacent units. Additionally remove and re-set any loose or shifted units and notify the Architect of any such conditions before proceeding.
   1. Store removed units in a safe location.
   2. Remove all existing setting, pointing and repair mortars from salvageable units.
   3. Clean removed units that will be reinstalled with specified cleaning techniques.
   4. Examine each unit for cracks and spalls. Verify repair treatments for each salvageable unit with the Architect.

F. Following removal of designated and/or loose masonry, mechanically clean remaining surfaces and restore the exposed remaining masonry as needed per the requirements of this Section.

3.03 GEOGRID INSTALLATION

A. Install stone courses to designated height of first geogrid layer. backfill and compact the wall drainage aggregate and reinforced fill in layers not to exceed 8" lifts behind wall to a distance equal to designed grid length. geogrid shall be laid horizontally on top of stone and level compacted backfill. pull grids taut, removing all slack. anchor/stake grid to the compacted fill prior to placing any additional fill material.

B. Proper grid orientation is critical- the strength direction of the grid (factory edge) must extend perpendicular to the face of the wall. Correct orientation of the geogrid shall be verified by the contractor. Strength direction is typically perpendicular to wall face.

C. Cut geogrid to designed embedment length and place on top of stone to within 1"+/- to exterior face of stone. Cut the grid in the longitudinal direction (perpendicular to the wall) wherever stones make an abrupt transition. Extend away from wall approximately 3% above horizontal on compacted infill soils.

D. Lay geogrid at the proper elevation and orientations shown on the construction drawings or as directed in the field by the engineer.

E. Follow manufacturer's guidelines for the installation.

F. Backfill and compact the drainage aggregate and reinforced soil mass in lifts not to exceed 8" behind wall to depth equal to designed grid length before grid is installed.

G. Place next course of stone on top of grid, remove slack and folds in grid and stake to hold in place (use non-corrosive stakes or remove as work progresses).

H. Adjacent sheets of geogrid shall be butted against each other at the wall face to achieve 100% coverage. Follow manufacturer's guidelines for overlap requirements, if required.

I. Geogrid lengths shall be continuous. Splicing parallel to the wall face is not allowed.

J. Tracked construction equipment shall not be operated directly on the geogrid. a minimum fill thickness of 6" is required prior to operation of tracked vehicles over the geogrid. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid. Rubber-tired equipment may pass over the geogrid reinforcement at slow speeds, less than 10 mph. Sudden braking and sharp turning shall be avoided.

3.04 PREPARATION OF JOINTS FOR REPOINTING

A. Rake mortar joints in existing construction in areas designated to be repointed to a minimum depth of 2.5 times the mortar joint width, 1", or as deeply as necessary to reach sound mortar (whichever is greatest), but not to exceed one half of the thickness of the masonry unit thickness without supplementary means of support. Employ tools that are sharp and will completely cut out joints at intersections without splitting or damaging masonry. Raking work shall match the approved test sample. During the tooling of joints, enlarge any voids or holes, except weepholes, and completely fill with mortar.

B. Gently drive wedges or hardwood shims into wide, deep cracks in masonry where there is a possibility that the vertical and in-plane lateral support of masonry work will be compromised during deep raking of the joints. This should at least be done where more than half of the length of a specific joint is removed to a depth of more than one third of the thickness of the masonry unit.

C. Cut flashing reglets in new or existing masonry as indicated on the Contract Drawings.

D. Wire brush clean and then pre-wet the joints and allow for the existing mortar to dry or saturate to a dull, non-glossy finish immediately before applying new mortar.

3.05 FINAL POINTING

A. Pre-wet prepared mortar joint surfaces until they are saturated but surface dry. At flashing reglets, verify that flashing has been fully installed and is stable.

B. Apply final "tuck" lift of pointing mortar, tooling joints to exactly match the existing joint profiles that are adjacent to the work.

C. Where so specified, point joints and beds with specified sealant after first installing the specified backup material and applying primer if required, all in strict accordance with the printed instructions of the sealant manufacturer. Test all sealants for compatibility prior to use. Tool all sealants to ensure maximum adhesion to contact surfaces.

D. Moist cure all work, spraying with a water mist and cover with damp cloth or tarpaulin.

E. Clean mortar from all surfaces following completion and curing of work.

F. Work under this subsection shall only be done when the ambient air, material, and substrate temperatures are above 40 degrees F. by 9:00 AM and rising.

G. The Contractor shall be responsible for matching the joints of the mock-up surrounding work and shall re-cut and replace any joints that are poorly formed or do not match the mock-up or the surrounding work, as determined by the Architect, at the Contractor's own expense.

H. Moist cure all work, spraying with a water mist and cover with damp cloth or tarpaulin.

I. Chemically clean all surfaces following completion and curing of work, being careful to reveal the mortar aggregate but to not over-etch, weaken or discolor the mortar. Remove excess mortar from the surface before it sets using a bristle brush or by rubbing the surface with burlap or clean sand. If mortar is left on the surface, wash surface clean using dilute solutions of Hydroclean HT-455.

J. Completed work shall match approved sample patch or shall be re-done at the Contractor's expense.

3.06 FINAL WASH-DOWN CLEANING

A. Clean completed masonry work before painting, flashing and sealant work that might be damaged or stained by the cleaning chemicals.

END OF SECTION

SECTION 05 12 23 STRUCTURAL STEEL FOR BUILDINGS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to Division 00 and Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.

B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials, and equipment necessary to complete the Work of this Section, including but not limited to the following:
   1. Structural steel members and fabrications

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this Section. Other Sections that relate directly to work of this Section include, but are not limited to the following:
   1. Section 02 44 00 – Shoring, Bracing & Support
   2. Section 03 30 00 – Cast-in-Place Concrete
   3. Section 06 10 00 – Rough Carpentry

1.04 REFERENCES

A. AISC - Code of Standard Practice - *Manual of Steel Construction* - Allowable Stress Design (ASD) and Load and Resistance Factored Design (LRFD)
B. ASTM A36 / A53 / A500 / A572 / A992 - Structural Steel
C. ASTM A276, Type 304 – Stainless Steel Plate, Rolled Section, and Threaded and Plain Round Bar Stock
D. ASTM A563 - Carbon and Alloy Steel Nuts
E. AWS A2.4 - Symbols for Welding, Brazing, and Nondestructive Examination
F. AWS D1.1 - Structural Welding Code

1.05 SUBMITTALS

A. Submit the following items to the Engineer for review:
   1. Shop Drawings of all metal fabrications showing field verified dimensions, locations of members, arrangement and type of bridging, and connections to be made in the field.
   2. Product literature for standard products and/or mass-produced items to be used.

1.06 QUALITY CONTROL

A. Comply with all referenced standards for the products employed.

B. Satisfy testing and inspection requirements of the Commonwealth of Massachusetts State Building Code and any requirements set by the local building inspector. Coordinate times of inspections.

C. Submit mill certificates from Steel Fabricator and Bolt / Rod supplier.

PART 2 - PRODUCTS

2.01 STRUCTURAL STEEL MATERIALS & FABRICATIONS

A. Bolts, Nuts, and Washers: ASTM A325 bolts, ASTM A563 nuts, galvanized to ASTM A123, and ASTM A276, Type 304 for outdoor applications.
B. Tensioning Rods: ASTM A572 Grade 50.
C. Steel pipe columns: ASTM A53
D. Steel tube columns: ASTM A500, Grade B
E. Steel plate: ASTM A36
F. Steel shapes: ASTM A992, Grade 50
G. Welding electrodes: AWS E70-XX for *new* steel
AWS E60-XX, low hydrogen for *existing* steel
H. Anchor Bolts to reconstructed masonry: ASTM F1554
I. Anchor Bolts to existing masonry and concrete: ASTM F1554
J. Grout for setting and supporting steel bearing surfaces: Non shrink type, pre mixed compound consisting of non metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 4,000 psi at six hours 7,000 psi at 28 days (may be more or less than six hours depending on specific product)
K. Detail members and connections to minimize or eliminate field welding wherever possible. Use bolted connections instead.

2.02 ADHESIVE ANCHORING SYSTEM FOR MISCELLANEOUS EMBEDDED ITEMS

A. For anchorage to Masonry: Hilti HY270 Adhesive Injection System with Screen Tubes as manufactured by the HILTI Corporation of Tulsa, OK.

B. For anchorage to Solid Concrete: Hilti HY200 Adhesive Injection System as manufactured by the HILTI Corporation of Tulsa, OK.

C. For anchorage to Solid Stone: Hilti RE500 Adhesive Injection System as manufactured by the HILTI Corporation of Tulsa, OK.

2.03 PROTECTIVE COATINGS FOR STEEL

A. All interior steel shall be coated with two heavy applications of Bar-Rust 235 as manufactured by International Protective Coatings, or approved equal.

B. All exterior steel shall be hot-dipped galvanized following fabrication, provide touch-up in the field as required with a zinc-rich cold galvanizing compound such as Zirp, ZRC or approved equal.

C. Provide product submittal *prior* to ordering protective coatings for approval by the architect.

PART 3 - EXECUTION

3.01 INSTALLATION OF STRUCTURAL STEEL ITEMS: GENERAL

A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

B. Field welding of any kind, including welding members and connections, should be avoided. If field welding cannot be avoided, provide a fire watch as required by any local codes and ordinances.

C. Torque all bolted connections to the appropriate resistance as per AISC and manufacturer's standards.

D. Do not field cut or alter structural members without approval of Architect.

E. After erection, prime welds, abrasions, and surfaces with field application of shop primer.

F. Work shall be done from approved shop drawings only.

G. Provide leveling nuts below all bearing and base plates and 1" to 1½" non-shrink grout between all steel and masonry or concrete contact surfaces for uniform bearing. Trowel edges of grouted surface smooth, splay neatly to 45 degrees.

H. Erect members to within ¼" tolerance from locations at which they are designated on shop drawings or as far as connections will allow, if less.

I. Demolish finishes only as necessary for installation of members and replace finishes to within the requirements of the Architect following installation. Re-attach and/or re-support all damaged or severed wall and ceiling furring, studding, joists and strapping to a true, stable condition in accordance with the specifications and drawing requirements.

3.02 INSTALLATION OF ANCHOR BOLTS & THREADED RODS TO EXISTING MASONRY & CONCRETE

A. Install Anchor Bolts and Threaded Rods to existing masonry and concrete in accordance with the following:
   1. Carefully drill holes of the proper oversize diameter for the screen tube (in masonry) and injection resin 1/8" and 1/4" larger in diameter than the anchor rod or pin, as specified by the manufacturer of the injection system.
   2. Locate and size anchor rods in accordance with contract drawings where specifically detailed and Architect's field instructions where hidden conditions require a deviation from the locations shown on the drawings.
   3. Provide embedments as noted or instructed but not less than 8" embedment at ½" diameter and larger anchors or 4" embedment at anchors of less than ½" diameter.
   4. Incrementally drill holes in concrete to avoid reinforcing steel, filling unused holes with repair mortar. Adjust locations of anchors as allowed by fittings or Architect to avoid existing steel.
   5. Use Hilti HY270 injection system with screen tubes where fastening to masonry and the Hilti HY200 injection system without screen tubes where fastening to solid concrete or masonry (use Hilti RE500 where specifically noted).
   6. Simultaneously with injection of holes, pre-butter surfaces of rods with injection resin so that there is a uniform coating all around the rod of between 1/16" and 1/8" in thickness and insert rods immediately thereafter.
   7. Wipe off excess resin and clean out remaining hole depth. *Do not allow resin to leak out of holes and stain stone surfaces*. Remove resin immediately if this happens!
   8. Monitor progress and quality of work, adjusting techniques as may be necessary, subject to approval of the Architect. Check that annular space is filled around the end of each rod following insertion. If properly installed, resin should be oozing out beyond end of rod all around annular space, showing that the annular space and the hole are completely filled. Supplementary injection may be necessary due to the presence of voids.

B. Work under this subsection shall only be done when the ambient air, material, and substrate temperatures are above 40°F by 9:00 AM and rising.

END OF SECTION

SECTION 05 50 00 – METAL FABRICATIONS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Design and fabrication drawings stamped by professional engineer registered in the Commonwealth of Massachusetts. The term "provide" in this Section shall mean to "design, size, detail, engineer, fabricate, furnish and install" the project components with all required accessories for a complete system installation.
   2. Provide color galvanized steel pipe rails and guards at the exterior stairs and landings to the 1848 front entry and 1895 entrances at both levels.
   3. Provide elevator pit ladder and elevator landing sills.
   4. Miscellaneous connectors, plates, fasteners and any other metal fabrications indicated on the Drawings or otherwise required by the Work.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 02 41 00 Demolition.
   2. Section 03 30 00 Cast-in-Place Concrete.
   3. Section 05 12 23 Structural Steel for Buildings.
   4. Section 06 10 00 Rough Carpentry.
   5. Section 06 20 13 Exterior Finish Carpentry.
   6. Section 06 20 23 Interior Finish Carpentry.
   7. Section 14 26 00 LU/LA Elevator.

1.04 REFERENCES

A. Comply with the following applicable standards:
   1. Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.
   2. Code of Standard Practice for Steel Buildings and Bridges.
   3. ASTM A 36 – Specification for Structural Steel.
   4. ASTM A563 - Carbon and Alloy Steel Nuts.
   5. AWS D1.1 – Structural Welding Code.
   6. AWS A2.4 - Symbols for Welding, Brazing and Nondestructive Examination.
   7. Metal Grating Institute.
   8. 780 CMR – The Massachusetts State Building Code.
   9. 521 CMR – Massachusetts Architectural Access Board Regulations; Americans with Disabilities Act.
   10. Other referenced standards as noted.

1.05 SUBMITTALS

A. Product Data: Submit to Architect for approval complete product data for all work of this SECTION. Data shall consist of complete product description, specifications, catalogue cuts, maintenance and care instructions and any other relevant information.
B. Shop Drawings: Submit to Architect for approval complete shop drawings indicating:
   1. Profiles, sizes, gauges, dimensions, modifications, connection of attachments, reinforcing anchorage, size and type of fasteners, and assembly of components.
   2. Welds and anchorages.
   3. Installation clearances.
   4. Adjust final shop drawings to reflect field dimensions of adjacent structure.
   5. Provide stamp by Professional Engineer licensed in the State of Massachusetts for structural assemblies, details and attachments.

1.06 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Prior to the start of work, Contractor shall inspect preparatory work and ensure that it is acceptable for subsequent follow on installation.
C. Contractor shall verify that all shop drawings, samples and other submittals are complete and have been reviewed by the Architect prior to beginning installation.
D. Contractor shall inspect installation daily to ensure compliance with Project requirements.
E. Contractor shall perform a final inspection of all installations, make all necessary corrections and ensure completion prior to Substantial Completion.
F. Exposed fastening shall be compatible materials, shall generally match in color and finish, and shall harmonize with the materials to which fasteners are applied. The necessary lugs and brackets shall be provided so that the Work can be assembled in a neat and substantial manner. Holes for bolts and screws shall be drilled or punched. Poor matching of holes shall be cause for rejection. Fastening shall be concealed where practical.
G. DISSIMILAR MATERIAL: In all cases where dissimilar metal, such as aluminum, steel, copper, etc. would join or be in contact, the metals shall be kept separated by suitable non-conducting gasket, or tape, or by painting the contact surface with a bitumastic coating or other approved insulating coating. Care shall be taken to prevent the bitumastic from showing on permanently exposed surfaces.
H. All surfaces shall be smooth and free of any sharp edges, corners or seams. Any units that fail to meet this criterium shall be repaired or replaced to the Architect’s satisfaction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Pack all components carefully to prevent damage. Brace and insulate to prevent bending and twisting or scratching of finished surfaces. Verify undamaged conditions.
B. After delivery, store carefully to prevent damage. Store in warm, dry location.
C. Protect from abuse or misuse at all times. Bent, scratched, or otherwise damaged items will not be accepted.
D. Ship components in largest possible sections to minimize field welding.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Guardrails, Handrails and Brackets:
   1. ASTM A500 steel newel posts, bars, tubes and balusters as noted and as required for loading conditions.
   2. Guardrails shall be in the dimensions and configurations indicated.
   3. Handrails shall be shown in the configurations indicated.
      a. Exterior guard-mounted handrails shall be 1.25" I.D. steel tubing with radiused turns and easings.
      b. Provide handrail extensions in conformance with 521 CMR and 780 CMR where space allows.
      c. Provide wall-mounted brackets and wall returns as detailed on the Drawings. Locate brackets at a maximum of 36" on center.
      d. All turns and transitions shall be fabricated with smooth radius; no miters will be allowed on handrail transitions.

B. Other Miscellaneous Metals:
   1. Provide other items as noted in the scope of work and in the Drawings. Verify suitability of material dimensions and specifiy appropriate methods of attachment to suit the intended purposes.

C. Conform to Volatile Organic Compounds (VOC) Rules and Regulations for shop applied metal primer.

2.02 COLOR GALVANIZING

A. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.
   1. Basis-of-Design: Duragalv by Duncan Galvanizing (Everett MA, 617-389-8440; http://www.duncangalvanizing) or approved equal.
   2. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware.
   3. Provide thickness of galvanizing specified in referenced standards.
   4. Galvanizing bath shall contain special high grade zinc and other earthly materials.
   5. Fill vent holes after galvanizing, if applicable, and grind smooth.

B. Factory-Applied Architectural Finish Over Galvanized Steel: Provide factory-applied architectural coating over hot-dip galvanized steel matching approved samples.
   1. Basis-of-Design: Colorgalv by Duncan Galvanizing (Everett MA, 617-389-8440; http://www.duncangalvanizing) or approved equal.
   2. Primer coat shall be factory-applied polyamide epoxy primer. Apply primer within 12 hours after galvanizing at the same galvanizer's plant in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer.
   3. Finish coat shall be factory-applied color-pigmented architectural finish. Apply finish coating at the galvanizer's plant, in a controlled environment meeting applicable environmental regulations and as recommended by the finish coating manufacturer. Finish coat shall exhibit a rugosity (smoothness) not greater than 4 rug (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of architectural and structural elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments.
   4. Coatings shall be certified OTC/VOC compliant and conform to applicable regulations and EPA standards.
   5. Apply the galvanizing, primer, and coating within the same facility and provide single-source responsibility for galvanizing, priming and finish coating.
   6. Clean galvanized surface to create an acceptable profile for coatings. Galvanizer shall certify that performance will be met without blast cleaning and coating will

be applied within 12 hours of galvanizing at the galvanizer's plant. If blasted, galvanizer shall certify that rugosity standards are met.

7. Primer shall meet or exceed the following performance criteria:
   a. Abrasion Resistance per ASTM D 4060 (CS17 Wheel, 1,000 grams load),1kg Load: 200 mg loss.
   b. Adhesion per ASTM D4541: 1050 psi.
   c. Corrosion Weathering per ASTM D5894, 13 Cycles, 4,368 Hours: Rating 10 per ASTM D714 for blistering; Rating 7 per ASTM D610 for rusting.
   d. Direct Impact Resistance per ASTM D2794: 160 in. lbs.
   e. Flexibility per ASTM D522, 180º Bend, 1 in. Mandrel: Passes.
   f. Pencil Hardness per ASTM D3363: 3B.
   g. Moisture Condensation Resistance per ASTM D4585, 100º F, 2000 Hours: Passes, no cracking or delamination.
   h. Dry Heat Resistance per ASTM D2485: 250º F.
8. Topcoat shall meet or exceed the following performance criteria:
   a. Abrasion Resistance per ASTM D 4060, CS17 Wheel, 1,000 Cycles 1kg Load: 87.1 mg loss.
   b. Adhesion per ASTM D 4541: 1050 psi.
   c. Direct Impact Resistance per ASTM D2794: >28 in. pounds.
   d. Indirect Impact Resistance per ASTM D2794: 12-14 in. pounds.
   e. Dry Heat Resistance per ASTM D2485: 200° F.
   f. Salt Fog Resistance per ASTM B 117 9,000 Hours: Rating 10 per ASTM D714 for blistering.
   g. Flexibility per ASTM D522, 180° Bend, 1/8 in. Mandrel: Passes.
   h. Pencil Hardness per ASTM D3363: 2H.
   i. Moisture Condensation Resistance per ASTM D4585, 100° F, 1000 Hours: No blistering or delamination Xenon Arc Test per ASTM D 4798: Pass 300 hours.

PART 3 – EXECUTION

3.01 EXAMINATION & PREPARATION

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.
B. Field measurements: verify dimensions of supporting structures at the project site and adjust final shop drawings to reflect actual field dimensions.

3.02 FABRICATION

A. Form metal components to accurate sizes and shapes, with clean lines and angles.
   1. Fabricate in accordance with building code and referenced standards.
   2. Fit and shop assemble in largest practical sections for delivery to site.
   3. Exposed Mechanical Fastenings: Locate unobtrusively consistent with design of component. Conceal fastenings to greatest extent possible.
   4. Fabricate stairs and landings with risers and treads of metal pan construction, ready to receive concrete and subsequent finishes.
B. Welding:
   1. Shop weld components to form integral units.
   2. Wire brush completed welds.
   3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed butt joints tight, flush, and hairline. Ease exposed edges to small uniform radius.
   4. Limit field welding to greatest extent possible. Provide adequate ventilation in areas where construction workers or other occupants of the building could be exposed to welding fumes.

5. Provide a constant fire watch during on-site welding operations in compliance with local authority requirements.

C. Supply all components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise. Pre-drill required holes to be used for anchorage and assembly prior to application of specified factory finish.
D. Accurately form components required for anchorage to adjacent components and to the building structure.
E. Pre-assemble and test all components in the shop. Ship to site ready for erection.
F. Fabricate handrails from pipe heated and bent smoothly without distortion. Do not cut and miter corners – all corners shall be radiused.
G. Clean all surfaces of oil, grease, scale, dirt and other foreign matter. Remove all burrs and smooth irregular surfaces. Apply shop primer in controlled environment and follow manufacturer's printed instructions for application.
H. Shop prime all components that are not to be color galvanized.

3.03 INSTALLATION

A. Install the work in accordance with "Quality Assurance" provisions, "References," Specifications and Professional Engineer's directives. Where these may be in conflict, the more stringent requirements shall govern.
   1. Set stairs, guards, railings and posts in position true to line, plumb, level, accurately fitted and secure.
   2. Provide welds, anchors, plates, and angles required for connecting components securely to structure.
   3. Permanently bolt and weld steel construction to match appearance of shop bolting and welding. Conceal bolts and screws whenever possible.
   4. Touch up marred shop primer to match shop applied primer.
   5. Leave assemblies securely rigid and free from defects.
B. Install all other components to assure a good fit with surrounding construction. Make any modifications that may be required after site fitting and touch-up of shop-finished surfaces.

3.04 ADJUSTING AND CLEANING

A. Reposition any misaligned units.
B. Touch-up damaged shop applied coatings in the field.
C. Clean all surfaces and leave all components in good condition.

END OF SECTION

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to Part A, Division 00 and Part B, Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials, and equipment necessary to complete the Work of this Section, including but not limited to the following:
   1. Floor, roof, and wall framing for floors where indicated
   2. Framing for new openings and infill of existing openings
   3. Reinforcement of existing structure
   4. New framing to accommodate load transfers
   5. Concealed wood blocking to support miscellaneous items and trim
   6. Furring for wall finishes
   7. All rough wood framing including miscellaneous blocking, wood cant strips, screeds, bracing, ledgers, grounds, furring, strapping, curbs, bucks, nailing strips, nailing inserts, sleepers, and all other incidental rough carpentry items.
   8. Plywood backboards for electrical and telecommunications equipment
   9. All blocking, backing and other concealed wood supports within floors, walls and ceiling for entire job including, but not limited to, blocking for specialties, plumbing fixtures, accessories, and casework. Blocking within partitions for the support of manufactured cabinets, specialties, door frames and other components as required.
   10. Engineered wood floor joists at first and second floors
   11. Engineered timber beams and posts

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this Section. Other Sections that relate directly to work of this Section include, but are not limited to the following:
   1. Section 01 45 23 Testing and Inspecting Services
   2. Section 03 30 00 Cast-in-Place Concrete
   3. Section 05 12 23 Structural Steel for Buildings
   4. Section 06 20 13 Exterior Finish Carpentry
   5. Section 06 20 23 Interior Finish Carpentry
   6. Section 08 11 00 Metal Doors and Frames
   7. Section 08 14 00 Wood Doors
   8. Section 09 21 00 Plaster & Gypsum Assemblies
   9. Section 09 28 13 Cementitious Backing Boards
   10. Section 10 28 13 Toilet Accessories
   11. Section 22 00 00 Plumbing
   12. Section 23 00 00 Mechanical
   13. Section 26 00 00 Electrical
   14. Section 27 41 00 Audiovisual Systems

1.04 REFERENCES

A. NDS-2015, National Design Standard for Wood Construction
B. ALSC (American Lumber Standards Committee) - Softwood Lumber Standards
C. APA (American Plywood Association)
D. AWPA (American Wood Preservers Association) C1 - All Timber Products - Preservative Treatment by Pressure Process
E. AWPA (American Wood Preservers Association) C20 - Structural Lumber Fire Retardant Treatment by Pressure Process
F. NELMA (Northeast Lumber Manufacturers' Association): Grading Rules
G. NFPA (National Forest Products Association)
H. NLGA (National Lumber Grades Authority)
I. SPIB (Southern Pine Inspection Bureau)
J. WCLIB (West Coast Lumber Inspection Bureau)
K. WWPA (Western Wood Products Association)
L. FSC (Forest Stewardship Council)

1.05 SUBMITTALS

A. Product data sheets for standard hangers and supports

B. Product data sheets for engineered lumber

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. iLevel by Weyerhaeuser, P.O. Box 9777, Federal Way, WA 98063; 888-453-8358; www.ilevel.com, or equal.

B. Simpson Strong-Tie, PO Box 10789, Pleasanton, CA 94588; 800-999-5099; www.strongtie.com, or equal.

2.02 LUMBER

A. Lumber Grading Rules: NFPA, RIS, SPIB, WCLIB or WWPA
   1. Beam, Joist, Rafter Framing, Nailing and Blocking: SPF Species, 1 or 2 grade, size as per drawings or as required by items being supported, 15% maximum moisture content
   2. Studding: SPF Species, 1 or 2 grade, size as per drawings, 15% maximum moisture content. "Stud" grade shall *not* be used.
   3. Wood in Contact with Exterior Masonry and Concrete: SYP Species, 1 or 2 grade, size as per drawings, kiln-dried after treatment (KDAT), 19% maximum moisture content, pressure preservative treated with Copper Quat (ACQ, Micronized Copper) to 0.25 pcf.
   4. Sills & Plates: SPF Species, 1 or 2 grade, size as per drawings, 5% maximum moisture content (kiln dried)
   5. Solid Posts and Beams (Interior): Hem Fir Species, No. 1 grade except as required for architectural finishes.
   6. Solid Posts (Exterior): Southern Pine No. 1 grade, ACQ treated 0.25 pcf, KDAT.
   7. Contractor is responsible for keeping all materials on site clean and dry before, during and after installation.

2.03 MANUFACTURED WOOD PRODUCTS

A. Provide the following manufactured wood products or approved equivalents:
   1. Laminated Veneer Lumber (LVL): "Microllam" as manufactured by Trus-Joist Macmillan (iLevel by Weyerhaeuser) or approved Equal. Fb=2,600 psi, E=1,900,000 psi, Fct=750 psi, Fcii=2,310 psi, Fv=285 psi
   2. Parallel Strand Lumber (PSL): "Parallam" as manufactured by Trus-Joist Macmillan (iLevel by Weyerhaeuser), or approved Equal. Fb=2,900 psi, E=2,000,000 psi, Fct=650 psi, Fcii=2,900 psi, Fv=290 psi
   3. Laminated Strand Lumber (LSL): “Timberstrand,” as manufactured by Trus-Joist Macmillan (iLevel by Weyerhaeuser), or approved Equal. Fb=1,700 psi, E=1,300,000 psi, Fct=680 psi, Fcii=1,400 psi, Fv=400 psi
   4. LVL/PSL material shall have a maximum moisture content of 5%. Contractor is responsible for keeping all materials on site clean and dry before, during and after installation.

2.04 SHEATHING

A. Plywood Floor and Roof Sheathing: APA Rated Sheathing, Span Rating 40/20; Exposure Durability 1; touch sanded ¾” min. thick or to match surrounding work where thicker.

B. Floor decking and subfloor (sheathing) thickness shall match the existing thickness but shall not be less than ¾”.

C. Underlayments: Furnish and install for the relevant flooring materiials.

2.05 FASTENERS AND CONNECTORS

A. Provide standard attachment hardware consisting of nails, bolts, screws, and standard fittings as noted on the drawings and as required. Hardware for rough carpentry shall be as follows:
   1. Bolts and Nuts: AISI / ASME Standard B18.2.1
   2. Lag Screws: AISI / ASME Standard B18.6.1
   3. Steel Washer Plates: Same as above or ASTM A36 for custom sizes
   4. Spikes: Galvanized, hardened steel meeting Federal Specification FF-N-105B.
   5. Standard Connectors (where specified or allowed): Items as manufactured by the Simpson Strong-Tie Company of San Leandro, CA, or approved equal
   6. Anchor Bolts: Diameter and spacing as noted on structural drawings, A307 rod with 90 degree hooks, 8” minimum embedment.

B. Provide non-standard attachment hardware as detailed on the drawings in accordance with Section 05 12 23.

C. Provide standard framing hangers and accessories that are equal or equivalent to the Simpson-Strong Tie products that are referenced on the drawings.

D. All roof rafters to wall plates are to be tied down with Simpson H2.5 hurricane ties, screws (“TimberLok” or similar installed per manufacturer’s instructions for uplift resistance), or equal.

E. All exterior connection hardware including nails, bolts, and fabricated connectors is to be hot-dipped galvanized *or* stainless steel (do not mix materials).Hot-dipped galvanized stock shall be G185.

PART 3 - EXECUTION

3.01 GENERAL FRAMING REQUIREMENTS

A. Provide standard galvanized metal connectors for all flush framed beam and joist applications. Capacities shall be suitable for the member and span as well as for uplift if at the roof.

B. Laminate multi-ply LVL beams, multi-ply built-up beams with 3 rows of 16 d nails at 12" o.c. per ply, or with two rows of 1/2" diameter through-bolts at 12" o.c. as per manufacturer's requirements. Provide 4 additional bolts each side of side supported beam connections.

C. Unless otherwise noted, nail all framing and plywood sheathing and decking in accordance with the Commonwealth of Massachusetts State Building Code and industry standards.

D. Provide all framing in accordance with proper and standard practice, and all governing codes. Contractor shall be prepared to correct any unsuitable conditions per the direction of the Architect.

E. All floor joist members of greater than 8'-0" span shall have one row of solid 2x bridging per 8 feet of span.

F. Provide solid blocking around all steel members and posts that pass through floors and walls, along with any other attachment as necessary to laterally restrain these members against buckling, twisting or any other lateral movement.

G. Wood construction is to conform to part II "design specifications" as published in the "Timber Construction Manual" (AITC) and to "National Design Specification for Wood Construction", latest editions adopted by The Massachusetts State Building Code.

H. New lumber for structural use is to be kiln dried and have a moisture content of not more than 15%. Contractor is responsible for keeping all materials dry before, during and after installation.

I. Wood construction shall conform to the Commonwealth of Massachusetts State Building Code.

J. Structural lumber is to be identified by the grade mark of, or certificate of inspection issued by, a grading or inspection bureau or agency recognized as being competent.

K. Structural lumber is to be visually graded lumber in accordance with the provisions of ASTM designation D245-74, "methods for establishing structural grades and related allowable properties for visually graded lumber."

L. Wood is to be handled and covered to prevent damage and moisture absorption from snow or rain.

M. Wood floor and roof construction:
   1. Splices are to occur only over bearing points.
   2. Joists shall be toe nailed to wood support with two 10d nails.
   3. Minimum bearing for rafters/joists = 1¾ inch at ends, and 3½ inches where members are continuous.
   4. Use metal rafter/joist hangers at all flush frame construction. Where no manufacturer hanger is available, fabricate from minimum 3/16" steel in the configuration of the most closely matching Simpson connector.
   5. Bridging will be solid using 2" x joist depth installed in offset fashion at conventional lumber joists. Maximum spacing = 10 feet.
   6. No rafter/joist is to be notched or drilled with holes without proper reinforcement.
   7. Joist/rafter support solely by nailing is not allowed by code.

N. Bearing walls:
   1. Studs are to be nailed to the sole plate with three 10d or four 8d toenails.

2. All studs to be continuous from floor-to-floor or roof-to-floor.
3. Sole plates shall be 2-2x or solid 4x material and nailed to subfloor and joists with 16d nails at each joist.
4. Top plates for bearing partitions are to be 2-2x, a continuous header, or as indicated on sections. Plate members of principal partitions are to be lapped or anchored to exterior wall framing. Splices are to be staggered and shall occur over studs. Nail plates to studs with two 16d nails at 24" o.c. Where wall plates are interrupted by steel posts, provide steel straps on both faces of wall plates to restore plate continuity
5. Top plates for non-bearing interior partitions may be single. Nail plate to stud with two 16d nails. When top plate is parallel to ceiling or floor framing, install 2x4 cross blocking not more than 4'-0" o.c.
6. When top plates are cut for piping or ductwork, reinforce with steel straps.
7. Bearing wall openings shall be supported with headers noted on plan, provide a minimum of 2-jack studs at each end and 1-king stud unless otherwise noted in plan.

O. Beams and girders shall not rest less than 3½” on supports.

P. All beams must splice only over supports unless specifically instructed otherwise by the Architect.

3.02 BLOCKING

A. Provide blocking as shown on the drawings, and as directed by the Architect, for attaching the following items where required:
   1. Railings
   2. Countertops
   3. Cabinets and casework
   4. Trim and paneling
   5. Towel bars, grab bars, and other kitchen and bathroom accessories
   6. Plumbing fixtures
   7. Other items as noted or required for the work

END OF SECTION

SECTION 06 20 13 - EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to Division 00 and Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not limited to the following:
   1. Refer to Drawings for limited exterior modifications and match adjacent work.
   2. Provide wood window jamb casings, head casing and sill for replacement of doorway with replicated window at east wall of Ground Floor level where shown.
   3. Provide matching infill woodwork for the Ell doorways (stair hall and accessible ramp) and for the balcony fire escape stair and doorway.
   4. Repair existing exterior walls where the two accessible ramps will be removed from abutting and concealing portions of the south wall of the 1848 building and east wall of the 1895 Ell.
   5. Provide replacement head and jamb casings at the relocated and modified accessible doorway into the First Floor of the Ell. Repair base of wall where ramp is removed; provide extensions to wood bases at Ell portico pilasters and column supporting entry roof.
   6. Provide wood decking, nosings and fascia at lowered wood entrance deck as indicated on the Drawings.
   7. Repair and patch portions of exterior carpentry where existing communication cabling, conduits, and other MEP devices are to be removed.
   8. Any other similar Work as required by the Project or as noted on the Drawings.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this Section. Other Sections that relate directly to work of this Section include, but are not limited to the following:
   1. Section 02 41 00 Demolition.
   2. Section 06 10 00 Rough Carpentry.
   3. Section 07 27 00 Air Barriers.
   4. Section 07 46 23 Wood Siding.
   5. Section 07 60 00 Flashing and Sheet Metal.
   6. Section 07 92 00 Sealants.
   7. Section 08 14 00 Wood Doors.
   8. Section 08 52 00 Wood Windows.
   9. Section 08 90 00 Louvers and Vents.
   10. Section 09 90 00 Painting and Coating.

1.04 SUBMITTALS

A. Shop drawings of profiles; samples of materials.

1.05 QUALITY ASSURANCE

A. Quality standard for fabrication and products: AWI *Architectural Woodwork Quality Standards*, Premium grade.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Anderson McQuaid, 170 Fawcett Street, Cambridge MA 02138; 617-876-3250; http://www.andersonmcquaid.com or approved equal.

2.02 MATERIALS

A. Exterior Trim and Replacement Components:
   1. Sapele in dimensions and profiles to match existing components.
B. Exterior Wood Decking at Ell Accessible Entrance:
   1. Ipe hardwood in dimensions and profiles noted.

PART 3- EXECUTION

3.01 EXECUTION

A. Provide work to sizes, shapes, and profiles indicated on approved shop drawings. Install work to comply with quality standards referenced.
B. Comply with manufacturer's requirements for shipping, delivery, storage on site, cutting, handling and fastening of materials.
C. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.
D. Provide exterior trim and replacement woodwork components to the painting subcontractor for complete priming of all sides of all trim elements prior to installation.
E. Use stainless steel fasteners for all work.
F. Install plumb, level and straight with tight joints. Scribe work to fit adjoining surfaces where applicable.
G. Repair minor damage, clean and protect.

END OF SECTION

SECTION 06 20 23 – INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to Division 00 and Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not limited to the following:
   1. Provide interior standing and running trim, mouldings, wainscoting, chair rails, picture rails, headrails, casings and other interior woodwork as noted in the Drawings.
   2. Salvage and re-use wood base, wainscoting and chair rails to the extent possible as noted in The Drawings. Replicate additional materials as required to match.
   3. Perform limited repairs or replacement of extant interior woodwork where damaged by previously installed surface-mounted or recessed devices that will be removed during selective demolition.
   4. Provide wood stile-and-rail inset cabinetry for Pantry area as indicated in the Drawings.
   5. Provide adjustable wall-mounted wood shelves with standards and brackets in the Pantry area as indicated in the Drawings.
   6. Install quartz countertops furnished under Section 06 61 19.
   7. Install toilet accessories furnished under Section 10 28 13.
   8. Provide wood frames for mirrors in toilet rooms as detailed in the Drawings.
   9. Provide wall-mounted wood handrails and metal wall brackets at interior stairway.
   10. Provide ladder and handrail for the attic demising access as shown.
   11. Provide all other interior finish carpentry components as indicated on the Drawings or required by the Work.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this Section. Other Sections that relate directly to work of this Section include, but are not limited to the following:
   1. Section 02 41 00 Demolition.
   2. Section 06 10 00 Rough Carpentry.
   3. Section 06 61 19 Quartz Surfacing Fabrications.
   4. Section 08 11 00 Metal Doors and Frames.
   5. Section 08 14 00 Wood Doors.
   6. Section 08 80 00 Glass and Glazing.
   7. Section 09 90 00 Painting and Coating.
   8. Section 10 28 13 Toilet Accessories.

1.04 REFERENCES

A. Architectural Woodwork Institute (AWI) *Architectural Woodwork Quality Standards*, 8th ed., Version 2.0; AWI, 46179 Westlake Drive, Suite 120, Potomac Falls, VA 20165; 571-323-3636; www.awinet.org.

1.05 SUBMITTALS

A. Shop Drawings of profiles and assemblies.
B. Actual samples of materials.

1.06 QUALITY ASSURANCE

A. Quality standard for fabrication and products: AWI *Architectural Woodwork Quality Standards*, Premium grade.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Trim: Anderson McQuaid, 170 Fawcett Street, Cambridge MA 02138; 617-876-3250; http://www.andersonmcquaid.com or approved equal.
B. Handrails: Crown Heritage, PO Box 130, North Wilkesboro NC 28659; 800-745-5931; http://www.crownheritage.com or approved equal.
C. Handrail Brackets: The Wagner Companies, PO Box 423, Butler WI 53007; 888-243-6914; http://www.wagnercompanies.com or approved equal.
D. Cabinetry: Crown Point Cabinetry, 462 River Road, Claremont NH 03743; 800-999-4994; http://www.crown-point.com or approved equal.

2.02 MATERIALS

A. Painted Trim: clear poplar in dimensions and profiles as shown on the Drawings.
B. Painted Cabinetry: based on Crown Point Cabinetry products for quality standard.
   1. Wood Specie: Hard rock maple.
   2. Door & Frame Style: Barnstead flat panel, square inset.
   3. Drawer: Flat front, epoxy-coated full extension heavy duty ball bearing slides.
   4. Hinges: Antique bronze hinges (pair per door) with ball finial tips.
   5. Knobs: EN-32-ORB, oil rubbed bronze.
   6. Finish: AcromaPro acrylic urethane, satin sheen.
   7. Shelves in Base Cabinet: pair of full extension sliding shelves with 2” high curb.
   8. Lazy Susan: Haefele or approved equal door-mounted insert in base cabinet.
C. Pantry Shelving: clear finished 3/4" thick birch plywood with solid edge wood banding 3/8” thick to match; mount on 1” wide double slot K&V or equal heavy-duty standards with brackets.
D. Stair Handrails: red oak 1 3/4” x 1 5/8” profile crown 6040 with all easings (starting and over and quarter turns to wall.
E. Wall-Mounted Handrail Brackets: malleable iron; painted under Section 09 90 00; flat saddle and three mounting holes; Wagner 1786-3, or approved equal; confirm width of saddle does not exceed width of flat profile at underside of railing.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that rough framing and substrates are plumb, true, and square before commencement of installation.

3.02 INSTALLATION

A. Provide work to sizes, shapes, and profiles indicated on approved shop drawings. Install work to comply with quality standards referenced.

B. Comply with manufacturer's requirements for shipping, delivery, storage on site, cutting, handling and fastening of materials.
C. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.
D. Back prime concealed surfaces of interior work that will abut masonry, concrete or exterior surfaces. Use non-corrosive fasteners for all work.
E. Install plumb, level and straight with tight joints. Scribe work to fit adjoining surfaces where applicable.
F. Repair minor damage, clean and protect.

END OF SECTION

SECTION 06 61 19 - QUARTZ SURFACING FABRICATIONS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to Division 00 and Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not limited to the following:
   1. Counters and backsplashes where indicated on the Drawings, including:
      a. Pantry counter and backsplash.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this Section. Other Sections that relate directly to work of this Section include, but are not limited to the following:
   1. Section 06 10 00 Rough Carpentry.
   2. Section 06 20 23 Interior Finish Carpentry.
   3. Section 07 92 00 Joint Sealants.
   4. Section 10 28 13 Toilet Accessories.
   5. Section 22 00 00 ***Plumbing (Filed Sub-Bid).

1.04 SUBMITTALS

A. Shop drawings showing the location of each item, dimensioned plans and elevations, and large-scale details. The drawings should show:
   1. Edge details, seam locations, attachment devices and other components.
   2. Locations and sizes of furring and blocking, including concealed blocking and any other reinforcement specified in other Sections.
   3. Locations and sizes of cutouts and holes for plumbing fixtures, faucets, electrical outlets, cable passage and other items installed in the countertop and backsplash areas.
B. Samples:
   1. Provide actual material samples for color selection.
C. Certifications:
   1. Submit manufacturer's signed certificate for each type of product.
   2. Submit fabricator/installer qualifications, with certification number.
   3. Submit compliance with NFS/ANSI standard 51 for use in food zone.
   4. Submit available HPD and EPD product declarations to the extent available.
D. Maintenance materials:
   1. Submit manufacturer's care and maintenance data, including repair and cleaning instructions.
   2. Include a maintenance kit for finishes in the project closeout materials.

1.05 QUALITY ASSURANCE

A. Work of this Section shall be by an experienced, certified fabricator/installer, certified in writing by the manufacturer.
B. Conduct a conference at the project site prior to installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver countertop to project site until preparatory work is ready to receive it.
B. Store countertop indoors prior to installation.
C. Handle materials carefully to prevent damage to finished surfaces, and cover the finished work to prevent physical damage or staining following installation for the duration of project.

1.07 WARRANTY

A. Provide manufacturer's warranty against defects in materials.
   1. Warranty shall provide material and labor to repair or replace defective materials.
   2. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.
B. Manufacturer's warranty period: Ten years (10) from date of Substantial Completion as established by the Architect.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products from one of the following manufacturers, or an approved equal:
   1. Cambria: https://commercial.cambriausa.com
   2. Silestone: http://www.silestoneusa.com
   3. Caesarstone: http://www.caesarstoneus.com

2.02 MATERIALS

A. Homogenous natural quartz surfacing material with the following characteristics:
   1. Gloss: 45-50%; ANSI Z-124.
   2. Nominal Weight: 10 lbs/cubic foot for 2cm; 15 lbs/cubic foot for 3cm thickness; 20 lbs/cubic foot for 4cm thickness.
   3. Density: ~2400 kg/m3.
   4. Moisture Absorption: Negligible, ASTM C-97.
   5. Compressive Strength: 24,750 psi, ASTM C-170.
   6. Surface Burning Characteristics: 17, Class A, Class 1 per ASTM E84.
   7. Smoke Developed: 196 Flaming, 69 Non-Flaming, ASTM E-662.
   8. Stain Resistance: Unaffected, ANZI -124.6.
   9. Fungal & Bacterial Resistance: No growth, ASTM G 21 & G 22.
B. Pantry Backsplash: 2 cm thick (3/4"), with 1/8" chamfer at outer corner of top and at vertical surface of returns to countertop; all locations.
C. Pantry Counter: 4cm thick horizontal counter with pencil edge at nosing and cutout for undermount sink.
D. Color and Pattern: to be selected from manufacturer's standards.

2.03 ACCESSORIES

A. Joint Adhesive: Manufacturer's standard one- or two-part adhesive to make inconspicuous, nonporous, color-matched joints. Horizontal surface of counter and all related component pieces shall each be fabricated from single lengths wherever possible.
B. Sealant: Manufacturer's standard mildew-resistant, FDA-compliant, UL-listed silicone sealant, color to match countertop material where visible.
C. Sink Mounting Hardware: Manufacturer's standard under-mount assembly.

2.04 FACTORY FABRICATION

A. Shop-fabricate components to the greatest extent practical to the sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions and technical bulletins.
B. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints.
C. Provide factory cutouts for sinks, faucets as indicated on the Drawings or referenced in the Specifications.
D. Rout and finish component edges with clean, sharp returns.
   1. Rout cutouts, radii, and contours to template.
   2. Smooth edges.
   3. Repair or reject defective and inaccurate work.

PART 3- EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.
C. Coordinate concealed counter bracket placement with plumbing prior to installation of rough piping.

3.02 INSTALLATION

A. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
   1. Provide product in the largest pieces available.
   2. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
   3. Reinforce at joints as needed.
   4. Cut and finish component edges with clean, sharp returns.
   5. Rout radii and contours to template.
   6. Anchor securely to base cabinet or other supports.
   7. Carefully dress joints smooth, remove surface scratches, remove any adhesive from exposed surfaces and clean entire surface.
B. Protect installed Work until Substantial Completion and repair any damaged portions.

END OF SECTION

SECTION 07 14 00 – FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Prepare surfaces and joints and install one coat of elastomeric waterproofing on exterior concrete surface (positive side) of foundation and stem walls.
   2. Install protective sheet over waterproofing at abutment of concrete slab to be supported by foundation wall.
   3. Install rigid insulation furnished under Section 07 21 00 – Board Insulation.
   4. Provide drainage board over rigid insulation for completed assembly of exterior foundation wall waterproofing system.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 03 30 00 Cast-in-Place Concrete.
   2. Section 04 43 00 Stone Masonry.
   3. Section 07 21 00 Board Insulation.
   4. Section 07 27 00 Air Barrier.
   5. Section 07 92 00 Joint Sealants.
   6. Section 31 20 00 Earthwork.

1.04 REFERENCES

A. ASTM C 836: High Solid Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane.

1.05 SUBMITTALS

A. Refer to Section 01 33 00 – Submittal Procedures for information.
B. Product Data: Submit product data, including manufacturer's specifications, installation instructions, and general recommendations for waterproofing applications.
C. Test Reports: Submit for acceptance, complete test reports from approved independent testing laboratories certifying that waterproofing system conforms to performance characteristics and testing requirements specified herein.
D. Submit manufacturer’s Health Product Declarations (HPD) and Environmental Product Declarations (EPD) to the extent that they are available for the products.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with the printed requirements of the membrane manufacturer and this specification. Advise Architect of any discrepancies prior to commencement of the Work.
B. Maintain one copy of manufacturer's literature on site throughout the execution of the Work.
C. At the beginning of the Work and at all times during the execution of the Work, allow access to site by the waterproofing membrane manufacturer's representative.
D. All materials used in this shall be fully compatible and shall be sourced and or produced by one manufacturer.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.
B. Cold applied elastomeric membrane should be stored in closed containers.
C. Store membrane at temperature of 40 degrees F and above to facilitate handling.
D. Store adhesives and primers at temperatures of 40 degrees F and above to facilitate handling.
E. Solvents away from open flame or excessive heat.
F. Do not store modified membranes at ambient temperatures below 20 degrees F.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Minimum working temperatures shall take into consideration a factor for wind chill. Application temperature shall be considered to be the temperature minus half of the wind speed as recommended by the National Roofing Contractors Association (NRCA).

1.09 COORDINATION

A. Ensure continuity of the waterproofing membrane throughout the scope of this section.
B. Work shall be so scheduled as to provide a watertight seal at the end of each working day on the areas worked upon during the day.

1.10 SITE CONDITONS

A. Environmental Requirements
   1. No installation work shall be performed during rainy or inclement weather and on frost or wet covered surfaces.
B. Protection
   1. Provide adequate protection of materials and work of this section from damage by weather backfilling operations and other causes.
   2. Protect work of other trades from damage resulting from work of this section. Make good such damage at own expense to satisfaction of the Architect.

1.11 PRE-CONSTRUCTION CONFERENCE

A. Following approval of submittals and prior to commencement of the Work, schedule a Pre-Construction Conference with the Owner, Architect, Contractor and Manufacturer's Representative to review all project conditions and details.

1.12 WARRANTY

A. Contractor shall warrant the waterproofing membrane for leak coverage for two years.

B. Waterproofing membrane manufacturer shall warrant the waterproofing membrane for leak coverage as a result of faulty materials for a period of (5) five years. Scope of warranty shall include the supply of materials required to return the membrane to a watertight condition. Scope of work does not include the removal of overburden.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Waterproofing membrane components and accessories must be obtained as a single-source from the membrane manufacturer to ensure total system compatibility and integrity.
   1. Basis-of-Design: Henry Company: www.henry.com
   2. Grace Construction Products; GCP Applied Technologies; www.gcpat.com
   3. Carlisle Coating & Waterproofing; www.carlisleccw.com

2.02 WATERPROOFING MEMBRANE

A. Primary waterproofing membrane shall be Henry CM100 Cold Applied Elastomeric Membrane or approved equal; moisture cure, solvent free elastomeric waterproofing compound having the following characteristics:
   1. Conforms to ASTM C 836,
   2. Solvent content: 0%,
   3. Non Flammable, Flash point > 450 F,
   4. Elongation: >500%,
   5. V.O.C < 40 grams/ Liter,
   6. Can be applied to “green” concrete.

2.03 FLASHING AND CRACK TREATMENT MEMBRANE

A. Flashing and crack treatment membrane shall be Henry 990-25 Elastomeric flashing sheet or approved equal; butyl/EPDM type, elastomeric membrane, 47 mils thick.

2.04 LIQUID MEMBRANE & TERMINATION SEALANT

A. Termination Sealant shall be HE925 BES Sealant or equal; moisture cure, medium modulus polymer modified sealing compound with the following physical properties:
   1. Compatible with sheet air barrier, roofing and waterproofing membranes and substrate.
   2. Complies with Fed. Spec. TT-S-00230C, Type II, Class A.
   3. Complies with ASTM C 920, Type S, Grade NS, Class 25.
   4. Elongation: 450 – 550%.
   5. Remains flexible with aging,.
   6. Seals construction joints up to 1 inch wide.

2.05 PREFABRICATED DRAINAGE BOARD

A. Drainage board shall be two part prefabricated geocomposite drainage board consisting of a formed polystyrene or PVC core covered on one side with a woven or non-woven polypropylene filter fabric supplied by Henry or approved equal:
   1. Henry DB 220: For vertical and horizontal installations, shallower depths with additional film attached to back side of membrane.

2.06 PROTECTION SHEET

A. Protection sheet shall be a glass-reinforced SBS modified bitumen sheet similar to Henry G100s/s, 80 mils thick.

2.07 RELATED PRODUCTS

A. Rigid Insulation – furnished per Section 07 21 00 – Board Insulation.
B. Backfill – provided per Section 31 20 00 – Earthwork.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Acceptable substrates are cast-in-place concrete and precast concrete.
B. Verify that surfaces and conditions are ready to accept the Work of this Section. Commencement of the Sork or any parts thereof shall mean acceptance of the substrate.

3.02 PREPARATION

A. All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar, frost or other contaminants. Fill spalled areas in substrate to provide an even plane and remove scaling or laitant concrete. Remove curing compounds or any foreign matter detrimental to the adhesion of the primary waterproofing membrane or membrane flashings.
B. New concrete should be cured for a minimum of 3 days and must be dry before waterproofing membranes are applied.

3.03 INSTALLATION OF CRACK TREATMENT AND FLASHINGS

A. Crack Treatment:
   1. Seal cracks and joints up to 1/8 inch in width with a 12 inch wide by 55 mil thick coating of the primary membrane and a 6 inch wide strip of fabric reinforcement centered over the joint.
   2. Seal cracks and joints up to 1/4 inch in width with a 12 inch wide by 55 mil thick coating of the primary membrane and a 6 inch wide strip of elastomeric crack treatment membrane centered over joint.
B. Membrane Flashing at Penetrations:
   1. At pipe penetrations provide elastomeric flashing sheet set into a 55 mil thick coating of primary membrane. Overcoat and seal with membrane. Install clamps as required.

3.04 SINGLE COAT COLD APPLIED ELASTOMERIC MEMBRANE APPLICATION

A. Application of Single Coat Vertical Layer:
   1. Ensure substrates are ready to receive primary waterproofing membrane.
   2. Apply membrane by squeegee, roller or trowel ensuring full bond of membrane to substrate.
   3. Apply single coat layer of primary membrane evenly to a minimum thickness of 55 mils to form a continuous monolithic coating over vertical surfaces including previously reinforced areas.

3.05 CURING AND PROTECTION

A. Allow membrane to dry thoroughly. Protect from rain until fully cured. Allow membrane to fully cure prior to installing rigid insullation drainage composite and backfilling. Patch or repair damaged areas using same material as original coating.
B. Protect cured membrane from damage caused by backfilling with rigid insulation and drain boards prior to commencing backfill.

C. At locations where portico and veranda slabs will be supported by and abut the foundation wall, provide protection sheet over the horizontal ledge and the adjacent vertical surface to completely cover and maintain the integrity of the waterproofing.

3.06 INSTALLATION OF FOUNDATION DRAINAGE BOARD

A. Align and hang drainage board up to foundation wall, position bottom edge of drainage board to be in moderate contact with footings in proximity to foundation drain system.
B. Secure drainage board to foundation wall through the rigid insulation with fasteners of the type and spacing as recommended by the manufacturer.
C. Overlap end laps, pull back loose fabric to expose drain core and position core of second panel over the first panel. Bend drain board to create inside corners and cut board to create outside corners, provide 3 inches of extra fabric to wrap corner.
D. Stagger or offset joints of drain board sheets. Place all subsequent sheets in an overlapping single fashion.
E. Backfill bottom edge in conjunction with foundation drainage system.

3.07 FIELD QUALITY CONTROL

A. Final Inspection and Approval:
   1. Final inspection of completed work shall be carried out by the Architect, Owner's Representative, General Contractor and Manufacturer’s Representative.

3.08 CLEAN-UP

A. Promptly as the work proceeds and on completion, clean up and remove from the premises all rubbish and surplus materials resulting from the foregoing work.
B. Clean to the Architect’s approval any soiled surfaces, spatters, and damage caused by work of this Section.
C. Check area drains to ensure cleanliness and proper function, and remove debris, equipment and excess material from the site.

END OF SECTION

SECTION 07 16 16 – CRYSTALLINE WATERPROOFING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Prepare surfaces and provide cementitious crystalline waterproofing on interior concrete surface (negative side) of elevator pit.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 03 30 00 Cast-in-Place Concrete.
   2. Section 07 92 00 Joint Sealants.
   3. Section 14 26 00 ***Limited Use/Limited Application Elevator (Filed Sub-Bid).
   4. Section 22 00 00 ***Plumbing (Filed Sub-Bid).

1.04 SUBMITTALS

A. Product Data: Submit product data, including manufacturer's specifications, installation instructions, and general recommendations for waterproofing applications.
B. Test Reports: Submit for acceptance, complete test reports from approved independent testing laboratories certifying that waterproofing system conforms to performance characteristics and testing requirements specified herein.
C. Refer to Section 01 33 00 – Submittal Procedures for information.

1.05 SYSTEM PERFORMANCE REQUIREMENTS

A. Testing Requirements: Crystalline waterproofing system shall have been tested in accordance with the following standards and conditions, and the testing results shall meet or exceed the performance requirements as specified herein.
B. Independent Laboratory: Testing shall have been performed by an accredited independent laboratory meeting the requirements of ASTM E 329 or other applicable international standard for certification of testing laboratories. Testing laboratory shall have obtained all control and treated concrete samples.
C. Crystalline Penetration: Crystallizing capability of waterproofing material shall be evidenced by independent SEM (Scanning Electron Microscope) photographs. Crystal growth 12 inches (30 cm) from the surface of the coating shall be evident with 1000X magnification 1 year after application of the coating and exposure of the sample to normal weathering.
D. Permeability: Independent testing shall be performed according to U.S. Army Corpsof Engineers CRD C48 “Permeability of Concrete”. Concrete samples shall have design strength of 2000 psi (14 MPa) and thickness of 2 inches (50 mm). Treated samples shall have two coats of crystalline waterproofing applied per

manufacturer's directions. Samples to be pressure tested to 175 psi (405 foot head of water) or 1.2 MPa (123.4 m head of water). Control samples shall leak and treated samples, after crystalline growth has occurred, shall exhibit no measurable leakage.

E. Permeability - Negative Side Application: Independent testing shall be performed according to EN 12390–8 or other recognized direct pressure test. Concrete samples shall have a design strength of 25 MPa (3600 psi). Treated samples shall be exposed to water pressure on the side opposite to the crystalline coating. Coated samples shall exhibit a greater than 90% reduction in depth of water penetration as compared to the control samples.

F. Chemical Resistance: Independent testing shall be performed according to ASTM C 267 "Chemical Resistance of Mortars" and ASTM C 39 "Compressive Strength of Cylindrical Concrete Specimens". Concrete samples (treated and untreated) shall have design strength of 4000 psi (27.6 MPa). Treated samples shall have two coats of crystalline waterproofing applied per manufacturer's directions. Untreated and treated specimens must be immersed for a minimum of 84 days in following chemical solutions: hydrochloric acid (3.5 pH), brake fluid, transformer oil, ethylene glycol, toluene, caustic soda. Treated specimens shall exhibit no detrimental effects after exposure, and shall have an average of 17% increase in compressive strength versus untreated control specimens.

G. Acid Resistance: Independent testing shall be performed to determine "Sulfuric Acid Resistance of Concrete Specimens." Treated concrete samples shall be tested against untreated control samples. All samples shall be immersed in 5% sulfuric acid and weighed weekly for 10 weeks. Untreated samples shall exhibit at least 8 times more mass loss than treated samples.

H. Carbonation Resistance Testing: Independent testing shall be performed according to RILEM CPC-18 or other recognized accelerated carbonation test. Concrete samples shall have a 0.5 w/cm ratio or be approximately 30 MPa (4500 psi) in strength. Coated samples shall have crystalline coating applied one day after casting and all samples to be cured for 7 days prior to carbonation. After 91 days exposure to CO_2 the coated samples shall show a 35% or greater reduction in carbonation depth as compared to the control samples.

I. Potable Water Approval: Waterproof material shall have a current, valid approval certificate from NSF (NSF 61), DWI, or other recognized certification agency.

1.06 QUALITY ASSURANCE

A. Manufacturer: Provide products of ISO 9001 registered manufacturer with no less than 10 years experience in manufacturing the cemetitious crystalline waterproofing materials for the required work.

B. Applicator: Waterproofing applicator shall be experienced in the installation of cemetitious crystalline waterproofing materials as demonstrated by previously successful installations.

C. Pre-Installation Conference: Prior to installation of waterproofing, conduct meeting with waterproofing applicator, installers of work adjacent to or which penetrates waterproofing, Architect, Owner's Representative, and waterproofing manufacturer's representative to verify and review the following:
   1. Project requirements for waterproofing as set out in Contract Documents.
   2. Manufacturer's product data including application instructions.
   3. Substrate conditions, and procedures for substrate preparation and waterproofing installation.

D. Technical Consultation: The waterproofing manufacturer's representative shall provide technical consultation on waterproofing application, including on-site support.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle waterproofing materials in strict compliance with manufacturer's instructions, recommendations and material safety data sheets.

B. Deliver packaged waterproofing materials to project site in original undamaged containers, with manufacturer's labels and seals intact.
C. Store waterproofing materials in dry, enclosed location, at a minimum temperature of 45ºF (7ºC). Protect from damage from sunlight, weather, moisture, excessive temperatures and construction operations.
D. Remove damaged material from the site and dispose of in accordance with applicable regulations.

1.08 PROJECT CONDITIONS

A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.
B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive waterproofing.

1.09 WARRANTY

A. Manufacturer's Warranty: Manufacturer shall provide standard product warranty executed by authorized company official.
B. Applicator's Warranty: Applicator shall warrant the waterproofing installation against defects caused by faulty workmanship or materials for a period of one (1) year from the date of Substantial Completion of the overall project as determined by the Architect. The warranty will cover the surfaces treated and will bind the applicator to repair, at his expense, any and all leaks through the treated surfaces which are not due to structural weaknesses or other causes beyond applicator's control such as fire, earthquake, tornado and hurricane. The warranty shall read as follows:
   1. Warranty: The applicator warrants that, upon completion of the work, surfaces treated with cemetitious crystalline waterproofing will be and will remain free from water leakage resulting from defective workmanship or materials for a period of one (1) year from the date of Substantial Completion of the overall project. In the event that water leakage occurs within the warranty period from such causes, the applicator shall, at his sole expense, repair, replace or otherwise correct such defective workmanship or materials. Applicator shall not be liable for consequential damages and applicator's liability shall be limited to repair, replacement or correcting of defective workmanship or materials. Applicator shall have no responsibility with respect to water leakage or other defects caused by structural failure or movement of the structure, or any other causes beyond Applicator's control.

PART 2 - PRODUCTS

2.01 MANUFACTURER & MATERIALS

A. "XYPEX CONCENTRATE" by Xypex Chemical Corporation; 13731 Mayfield Place, Richmond, B.C., Canada V6V 2G9; www.xypex.com.
B. "VANDEX SUPER" by The Euclid Chemical Company; 19218 Redwood Road, Cleveland OH 44110; www.euclidchemical.com.
C. "PERMAQUIK 200" by Tremco Commercial Sealants & Waterproofing; 1451 Jacobson Avenue, Ashland OH 44805; www.tremcosealants.com.
D. Source Quality*:* Obtain all proprietary crystalline waterproofing products from a single manufacturer. Basis of design and installation instructions herein are based upon the manufacturer's guidelines for Xypex products. If an approved equal is used, installation instructions for that product shall be submitted and followed.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Site Visit: Prior to waterproofing installation, arrange visit to project site with waterproofing manufacturer's representative. Representative shall inspect and certify that substrate surfaces are in acceptable condition to receive waterproofing treatment.
B. Verification of Substrates: Verify that surfaces are sound and clean, and that form release agents and materials used to cure the concrete are compatible with waterproofing treatment.
C. Examination for Defects: Examine surfaces to be waterproofed for structural defects such as honeycombing, rock pockets, faulty construction joints and cracks. Repair defects per manufacturer's guidelines.
D. Removal of snap ties, where applicable, shall be performed by the General Contractor and shall be removed so that the ties remaining are recessed in the walls.
E. Any pumping necessary to hold down ground water and reduce pressure sufficiently enough to allow the unhindered application of waterproofing shall be performed by the General Contractor. Such pumping shall be continued on a 24 hour basis for a minimum of 48 hours after the Waterproofing installation has been completed.
F. The General Contractor shall leave the area broom clean prior to commencing of work by the waterproofer.

3.02 PREPARATION

A. Surface Preparation: Smooth surfaces (e.g. where steel forms are used) or surfaces covered with form oil or other contaminants shall be cleaned, water-blasted, lightly sand-blasted, or acid-etched as necessary to provide a clean absorbent surface. The surface must also have an open capillary system to provide "tooth and suction" for the cementitious crystalline treatment. A minimum of CSP-3 per the International Concrete Repair institute Concrete Surface Profile Chips or other equivalent standard is required. Surfaces to be acid-etched shall be saturated with water before application of the acid. After acid etching, flush concrete thoroughly with clean water. Horizontal surfaces shall have a rough wood float or broom finish. Where a smooth trowel finish is required on horizontal surface, crystalline waterproofing material shall be applied by dry shake method at time of concrete finishing in accordance with manufacturer's product data.
B. Repair of Defects*:* Concrete defects shall be repaired in accordance with manufacturer's technical literature. Procedures are generally as follows:
   1. Cracks and Faulty Construction Joints:
      a. Chip out cracks, faulty construction joints and other defects to a depth of 1.5 inches (37 mm) and a width of one inch (25 mm). A "V" shaped slot is not acceptable. The slot may be saw cut instead of chipped but ensure that the slot is dovetailed or otherwise shaped such that there will be mechanical interlock of materials placed into the slot at a later stage.
      b. Clean slot of debris and dust. Soak area with water and remove excess surface water. Apply a slurry coat of Xypex Concentrate at the rate of 1.5 lb./sq. yd. (0.8 kg/m^2) to the slot.
      c. While slurry coat is still tacky, fill cavity with Dry-Pac. Compress tightly into cavity using pneumatic packer or block and hammer.
      d. This step may be omitted if the area filled with Dry-Pac will be subsequently covered with Xypex coating. Wet Dry-Pac surface lightly with water, then apply a slurry coat of Xypex Concentrate at a coverage rate of 1.5 – 2 lb./sq. yd. (0.8 – 1 kg/m^2) over the repaired area to 6" (150 mm) on either side of slot.
   2. Rock Pockets, Honeycombing or other defective concrete: All areas of poor concrete consolidation (honeycomb or rock pockets) shall be repaired.

C. Wetting Concrete: Xypex requires a saturated surface dry (SSD) substrate. Concrete surfaces must be thoroughly saturated with clean water prior to the application so as to aid the proper diffusion of the Xypex chemistry and to ensure the growth of the crystalline formation deep within the pores of the concrete. Remove excess water before the application such that there is no glistening water on the surface. If concrete dries out before application, it must be re-wetted.

3.03 APPLICATION

A. Sealing Strips: Where hydrostatic conditions exist, sealing strips shall also be applied at construction joints by filling grooves that are created along the joints. Dimensions of the grooves shall be 1-inch (25 mm) wide and 1.5-inches (37 mm) deep. If grooves are not pre-formed then chip grooves to those dimensions. Fill the groves as follows:
   1. Apply slurry coat of Xypex Concentrate slurry to slot in accordance with manufacturer's instructions or recommendations.
   2. While slurry coat is still tacky, fill slot with Xypex Concentrate Dry-Pac.
   3. Compact tightly using pneumatic packer or hammer and block.
   4. This step may be omitted if the area filled with Dry-Pac will be subsequently covered with Xypex coating. Wet Dry-Pac surface lightly with water, then apply a slurry coat of Xypex Concentrate at a coverage rate of 1.5 – 2 lb./sq. yd. (0.8 – 1 kg/m^2) over sealing strip and extending to 6" (150 mm) on either side.

B. Form Tie Holes: Form tie holes shall be waterproofed in accordance with manufacturer's technical literature. Procedures are generally as follows:
   1. Prepare the tie hole to create a straight sided void with a profile of at least ICRI CSP-3. For through element ties holes such as those created by taper ties the prepared void is to be at least 5" (125 mm) deep. For cone ties the void is to be to the bottom of the cone.
   2. Clean and profile the area to a 12-inch (300 mm) diameter around the tie hole to an ICRI CSP-3 profile.
   3. For through-element tie holes create a solid plug of material at the bottom of the profiled hole using Xypex Patch'n Plug leaving at least 4" (100 mm) of empty tie hole from the top of the plug to the surface of the concrete element.
   4. Apply a coat of Xypex Concentrate slurry at a rate of 1.5 lb./sq. yd. (0.8 kg/m^2) to the inside of the tie hole and to a 12" (300 mm) diameter area around the hole.
   5. Fill and compact the tie hole with Xypex Concentrate Dry-Pac.
   6. This step may be omitted if the area filled with Dry-Pac will be subsequently covered with Xypex coating. Wet Dry-Pac surface lightly with water, then apply a slurry coat of Xypex Concentrate at a coverage rate of 1.5 - 2 lb./sq. yd. (0.8 - 1 kg/m^2) over the repaired area to a 12" (300 mm) diameter area around the filled void.

C. Surface Application: After repairs, surface preparation, treatment of construction joints and sealing strip placement have been completed in accordance with manufacturer's product data and as specified herein, apply Xypex treatment to concrete surfaces with semi-stiff bristle brush, push broom (for large horizontal surfaces), or suitable spray equipment. The Xypex coating must be uniformly applied and should be just under 1/16" (1.25 mm) thick. Application rates and locations shall be as indicated in the drawings and in accordance with manufacturer's product data. When brushing, work slurry well into surface of the concrete, filling surface pores and hairline cracks. When spraying, hold nozzle close enough to ensure that slurry is forced into pores and hairline cracks.
   1. First Coat: Apply Xypex Concentrate slurry coat to locations indicated on drawings in accordance with manufacturer's product data.
   2. Second Coat: Where indicated on drawings or as required by manufacturer's product data, apply Xypex Modified or Xypex Concentrate slurry coat after the first coat of Xypex Concentrate has reached an initial set but while it is still "green" (less than 48 hours). Curing by misting the coating with water should be done between coats. Ensure first coat is in SSD condition before application of the second coat.

3.04 CURING

A. General: Begin curing as soon as Xypex coating has hardened sufficiently so as not to be damaged by a fine spray. Cure Xypex treatment with a mist fog spray of clean water three times a day for 2 to 3 days. Wet burlap and some specialty curing blankets are also effective for curing during the prescribed period. In warm climates, more than three sprayings per day may be necessary to prevent excessive drying.
B. Air Circulation: Do not lay plastic sheeting directly on the waterproofing coating as air contact is required for proper curing. If poor air circulation exists in treated areas, it may be necessary to provide fans or blown air to aid in curing of waterproofing.
C. Protection: During the curing period, protect treated surfaces from damage by wind, sun, rain, puddling of water and temperatures below 36°F (2°C). If plastic sheeting is used for protection, it must be raised off of the waterproofing coating, avoiding direct contact with the surface, in order to allow sufficient air circulation.

3.05 CLEANING AND PROTECTION

A. Cleaning: Clean spillage and soiling from adjacent surfaces using appropriate cleaning agents and procedures.
B. Maintain minimum recommended temperature and protect application from freezing for at least three days following installation.
C. Protection: Take measures to protect completed waterproofing from damage after application. Do not permit disturbance of uncured, unprotected coating.

END OF SECTION

SECTION 07 21 13 - BOARD INSULATION

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to Division 00 and Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not limited to the following:
   1. Foam board thermal insulation under concrete slabs on grade in portions of the Ground Floor where slabs are to be provided and/or replaced as noted.
   2. Foam board thermal continuous insulation on exterior of concrete foundation and stem walls at reconfiguration of Ground Floor accessible entrance.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this Section. Other Sections that relate directly to work of this Section include, but are not limited to the following:
   1. Section 01 45 23 Testing and Inspecting Services.
   2. Section 02 41 00 Demolition.
   3. Section 03 30 00 Cast-in-Place Concrete.
   4. Section 07 26 16 Below-Grade Vapor Retarder.

1.04 REFERENCES

A. Foam board thermal insulation:
   1. BOCA Research Report 91-54
   2. ASTM C 578-92 Type IV
   3. UL Classification Certificate U-197
B. Protection board:
   1. BOCA Research Report 21-02
   2. ASTM C272, C 518, D1621, E96
   3. UL Classification Certificate U589

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect materials from sunlight and mechanical damage.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Owens Corning, 1 Owens Corning Parkway, Toledo, OH 43659; 800-GET-PINK; www.owenscorning.com, or approved equal (“Styrofoam” by Dow Chemical; “Thermal Star” by Atlas EPS).

2.02 MATERIALS

A. Rigid extruded polystyrene closed-cell foam board thermal insulation; ASTM C 578 Type IV; Owens-Corning “Foamular” 250 XPS or equal.
B. Thermal resistance 5.0 per inch at 75°F; 5.4 at 40°F mean temperature; UL Classified U-197; ASTM E 119.
C. Minimum 25 PSI compressive strength.
D. Thickness:
   1. Below Slab: two-inch.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are suitable to accept work as outlined in this section.

3.02 INSTALLATION

A. Follow manufacturer’s printed guidelines for proper installation in all locations.
B. Insulation board under concrete slabs: Lay rigid boards under the below-grade vapor sheets, tightly butting the boards against each other.
C. Do not place the insulation board under concrete footings.
D. Remove and dispose of excess insulation, wrappings and other waste materials.

END OF SECTION

SECTION 07 21 16 - BLANKET INSULATION

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to Division 00 and Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not limited to the following:
   1. Mineral wool sound attenuation fire blanket insulation where indicated.
   2. Filling of voids at penetrations and intersection of building components as backing and support for penetration fire-stopping, sealants and backer rods.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this Section. Other Sections that relate directly to work of this Section include, but are not limited to the following:
   1. Section 02 41 00 Demolition.
   2. Section 06 10 00 Rough Carpentry.
   3. Section 06 20 23 Interior Finish Carpentry.
   4. Section 09 21 16 Gypsum Board Assemblies.

1.04 REFERENCES

A. NFPA 101 – Class A rated interior finish.
B. ASTM C 665 – Type 1, per Federal Specification HH-1-521 F.
C. ASTM E 136 – Rated Non-combustible per NFPA Standard 220.
D. ASTM C 1104 – Absorbs less than 1% by volume.

1.05 SUBMITTALS

A. Submit to the Architect for approval complete product data for all work of this Section. Data shall consist of product description, specifications (including thermal resistance, STC data, water vapor transmission, and fire resistance), and materials safety data sheets.

1.06 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Provide materials which do not contain asbestos formaldehyde or other known toxins that contribute toward poor indoor air quality. Confirm compatibility of materials with all substrate conditions. Review field conditions and proposed installation with local authorities having jurisdiction prior to installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Thermafiber®: 3711 Mill Street, Wabash IN 46992; 888-834-2371; http://www.thermafiber.com
B. Simpson Strong-Tie: PO Box 10789, Pleasanton CA 94588; 800-999-5099; http://www.stongtie.com
C. Johns Manville Insulation Systems, 717 17th Street, Denver CO 80202; 800-654-3103; http://www.jm.com

2.02 MATERIALS

A. Thermafiber® SAFB™ (Sound Attenuation Fire Blankets); Unfaced Mineral Wool Batts; Creased; ASTM E 84 tested; provide in thicknesses and widths noted.
   1. Nominal density: 2.5 pcf.
   2. "K" @ 75º F (24ºC) BTU.in/hr.sq.ft. – 0.27.
   3. "R" Value per inch of thickness – 3.7.
   4. Flame spread – 0.
   5. Smoke developed – 0.
   6. Interior wall locations: in partitions where noted in the partition notes on A-04.
   7. Interior ceiling locations: in joist cavities where noted in ceiling notes on A-04.
B. Insulation supports: Simpson Strong-Tie IS insulation supports, or equal; 14-gauge carbon steel 0.08 diameter springwire with mitered tips.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation to adjacent construction. Coordinate with work of other sections.
B. Provide full thickness of insulation in one layer over entire area, tightly fitting around perimeter and any penetrations.
C. Hold insulation back a minimum of 4" from uninsulated recessed lighting, if any.
D. In all locations, do not allow installation of gypsum wallboard or other enclosing materials on the open side of construction until the Architect has observed and approved the insulation installation.
E. Provide loose fill insulation above ceiling spaces where noted on the Drawings, filling to a depth of 8" minimum. Confirm the presence of previously installed loose fill in the area of Work and top off settled insulation at exposed upper portions of the rafter spaces from the attic areas where noted in the Drawings.
F. Remove and dispose of excess insulation, wrappings and other waste materials.

END OF SECTION

SECTION 07 21 19 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to Division 00 and Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not limited to the following:
   1. Foamed-in-place closed-cell polyurethane insulation in the following locations and thicknesses:
      a. Exterior stud walls: minimum 3 1/2” thickness in existing stud cavities.
      b. Underside of roofs: minimum of 8” thickness below existing roof sheathing.
      c. At rim joist: 3.25” maximum thickness.
   2. Water based intumescing coating.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this Section. Other Sections that relate directly to work of this Section include, but are not limited to the following:
   1. Section 03 30 00 Cast-in-Place Concrete
   2. Section 05 12 23 Structural Steel for Buildings
   3. Section 06 10 00 Rough Carpentry
   4. Section 07 21 00 Board Insulation
   5. Section 07 21 16 Blanket Insulation
   6. Section 07 26 16 Below-Grade Vapor Retarders
   7. Section 07 27 00 Air Barrier

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   2. ASTM C 1338 – Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings
   3. ASTM D 1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
   4. ASTM D 1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
   5. ASTM D 1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
   6. ASTM D 2126 Standard Test Method for Dimensional Stability of Rigid Cellular Plastics
   7. ASTM D 2842 Standard Test Method for Water Absorption of Rigid Cellular Plastics
   8. ASTM D 2856 - Standard Test Method for Open-Cell Content of Rigid Cellular Plastics by the Air Pycnometer.
   9. ASTM D 6226 Standard Test Method for Open Cell Content of Rigid Cellular Plastics.

10. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
11. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
12. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

B. International Code Council - International Building Code:
   1. 2009, 2012, 2015 and 2018 Section 104.11 Alternative materials, design and methods of construction and equipment.
   2. Section 2603 Foam Plastic Insulation.

C. International Energy Conservation Code (IECC)
   1. 2009, 2012, 2015 and 2018

1.05 SUBMITTALS

A. Submit under provisions of Section 01 30 00 Submittal Procedures.
B. Before commencing work, submit in accordance with local code.
   1. Submit technical data sheets and samples as required by local code officials.
   2. Submit the technical data sheet from the manufacturer showing the test results from the ASTM E84 (Surface Burning Characteristics).
C. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until installation is approved by Architect.
   3. Rework mock-up area as required to produce acceptable work.

1.06 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
B. Ventilate area to receive insulation to maintain safe working conditions.
C. Protect workers as recommended by standards and manufacturer’s recommendations.
D. Protect adjacent surfaces, windows, equipment and site areas from damage of overspray.

1.07 QUALITY ASSURANCE

A. Foamed-in-place insulation must be installed by a qualified spray polyurethane foam applicator who is familiar with the operation and maintenance of his equipment and who is familiar with the properties of the product which is being applied.
B. Installer must be trained and certified by the manufacturer of the selected product.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered in manufacturer's original containers clearly labeled with manufacturer's name, product identification, safety information, net weight of contents and expiration date.
B. Material shall be stored in a safe manner and where the temperatures are in the limits specified by the material manufacturer.
C. Empty containers shall be removed from site on a daily basis.

1.09 WARRANTY

A. Manufacturer's Warranty: Spray-in-place urethane foam insulation, when installed by certified contractors using factory-trained applicators and applied in accordance to the Product Specification, will perform as stated in the Product Technical Data Sheet.
   1. Warranty will be in effect throughout the life of the building provided the original purchaser registers with the Warranty Department of the Manufacturer within thirty days of occupancy.
   2. Manufacturer's sole responsibility under this Limited Lifetime Warranty shall be to repair or replace any defective Product at the cost of the material only.
   3. Manufacturer shall not be responsible for labor cost or any other costs whatsoever related to, or in connection with the removal or installation of either the original or replacement product.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Basis-of-Design: Huntsman Building Products (formerly DEMILEC); 888-224-1533; http://www.demilec.com
B. Other manufacturers:
   1. BASF Corporation; 888-900-FOAM; http://www.spf.basf.com
   2. Lapolla Industries; 877-636-2648; http://www.lapolla.com

2.02 SPRAY FOAM INSULATION

A. Spray Applied Rigid Polyurethane Closed Cell Foam Insulation System:
   1. Basis-of-Design Product: HEATLOK® HFO High Lift manufactured by Huntsman Building Products, (formerly Demilec), or approved equal.
   2. Product Approval:
      a. Code Compliance Research Report, (CCRR) designed by Deer Ridge Consulting, Inc.
      b. Approved for use in building types I, II, III, IV, and V construction under IBC and dwellings for IRC.
      c. Approved for use in wall cavities, floor assemblies, ceiling assemblies, and attics and crawl spaces in Type VB construction under IBC and dwellings under IRC.
      d. Passed AC 377 Appendix X compliant NFPA 286.
   3. Installation:
      a. Application with a Prescriptive Thermal Barrier: There is no thickness limit when installed in floors or ceilings behind 1/2 inch gypsum wall board or equivalent 15 minute thermal barrier in accordance with IBC 2603.4 or IRC R316.4.
      b. Application without a Thermal Barrier: Up to 11-1/2 inches (292 mm) on the underside of the roof sheathing or in floor assemblies and 7-1/2 inches (191 mm) on vertical surfaces with all foam surfaces covered with a minimum of 12 mils DFT of DC-315 Fireproof Paint or a minimum of 12 mils DFT of Blazelok TBX.
      c. Attics and Crawlspaces: Passed AC 377 Appendix X compliant NFPA 286. Up to 11-1/2 inches (292 mm) on the underside of the roof sheathing or in floor assemblies and 7-1/2 inches (191 mm) on vertical surfaces, the insulation may be left exposed without a thermal barrier, ignition barrier or intumescent coating.
      d. Use on Attic Floors: Up to 11-1/2 inches (190.5mm) between and over the joists in attic floors.
      e. Use as Vapor Retarder: Class II vapor retarder at less than 1.0 perm, HEATLOK HFO High Lift minimum thickness of 0.7 inches.

4. Physical Properties:
    a. R-Value/in at 4 inch (ASTM C518): 7.5 ft2hdegreesF/BTU.
    b. R-Value/in at 1 inch (ASTM C518): 6.3 ft2hdegreesF/BTU.
    c. R-Value at 6.5 inches (ASTM C518): 48 ft2hdegreesF/BTU.
    d. R-Value at 4 inches (ASTM C518): 30 ft2hdegreesF/BTU.
    e. R-Value at 2 inches (ASTM C518): 14 ft2hdegreesF/BTU.
    f. Core Density (ASTM D 1622): 2.2 lb/ft3/
    g. Water Vapor Permeance (ASTM E 96): Less than 1 perm at 0.7 inches.
    h. Air Permeance at 75 Pa at 1inch (ASTM E 2178): Less than 0.02 L/sm2.
    i. Air Leakage at 75 Pa at 1 inch (ASTM E 283): Less than 0.02 L/sm2.
    j. Compressive Strength (ASTM D 1621): 34.8 lb/in2 (240 kPa).
    k. Tensile Strength (ASTM D 1623): 101.3 lb/in2 (699 kPa).
    l. Dimensional Stability (ASTM D 2126): 11.4 (% volume change) at 158 degrees F (70 degrees C) 97% R.H.
    m. VOC Content, Greenguard Gold: PASS, Meets Criteria/
    n. Flame Spread (ASTM E84): Class I, 0-15.
    o. Smoke Developed (ASTM E84): Class I, 350 - 400.
    p. Recycled Content, Finished Foam Renewable & Recycled Content: 12%.
    q. Recycled Content, Polyol Renewable Content: 6%
    r. Recycled Content, Polyol Recycled Content: 19%.
    s. Fungi Resistance (ASTM C 1338): No Fungal Growth.
    t. Closed Cell Content (ASTM D 2856): 91%.
5. Equipment used to apply the foam insulation shall have fixed ratio positive displacement pumps and approved by foam manufacturer.

2.03 THERMAL BARRIER

A. Water Based Intumescing Coating:
    1. Product: BLAZELOK® TBX, Distributed by Huntsman Building Products (formerly Demilec), Manufactured by TPR2.
    2. Approval: Complies with 2009 IBC 2603.9 and 803.2; 2009 IRC 302.9.4 and 316.6; 2006 IRC 314.6 and 315.4 and the NFPA 101 paragraph 10.2.3.7.2 for use without a prescriptive thermal barrier.
    3. Application: Follow manufacturer's application recommendations.
    4. Physical Properties:
        a. Surface Burning Characteristics (ASTM E 84): Class I. Flame Spread Index less than 25, Smoke Developed Index less than 50.
        b. Expands up to 2000 percent.
        c. Flash Point: None.
        d. Volatility/VOC: Less than 50 g/L.
        e. Non-toxic, drain safe, water based, non-fuming.
        f. Can be latex or oil base top coated.
    5. Color: Dull flat white / gray.
        a. Do not add tint.
        b. Wait minimum 24 hours prior to top coating with quality latex paint. Verify dryness with moisture meter.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
C. Commencement of work outlined in this section shall be deemed as acceptance of existing work and conditions.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Apply only when surfaces and environmental conditions are within limits prescribed by the material manufacturer.
C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install spray foam insulation in accordance with manufacturer's instructions. Apply as recommended by manufacturer to the minium thickness noted in each area.
B. During installation take all necessary precautions to prevent foam pressure (present during the application process) from displacing or bending framing members or sheathing. For similar reasons do not apply foam insulation in the shim space between window and door frames and the surrounding window and door framing.
C. Apply thermal barrier as required by applicable codes noting the following:
   1. Section 2603.4 of the 2015 International Building Code requires all plastic insulation shall be separated from the interior of the building by an approved thermal barrier of 1/2 inch (13 mm) gypsum wallboard or equivalent thermal barrier material.
   2. Code compliant fire protection may be achieved with the use of BLAZELOK TBX.

3.04 PROTECTION

A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07 26 16 - BELOW-GRADE VAPOR RETARDERS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to Division 00 and Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not limited to the following:
   1. Vapor retarder under interior concrete slabs on grade.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this Section. Other Sections that relate directly to work of this Section include, but are not limited to the following
   1. Section 01 45 23 Testing and Inspecting Services.
   2. Section 03 30 00 Cast-in-Place Concrete.
   3. Section 07 21 13 Board Insulation.
   4. Section 14 26 00 ***LU/LA Elevators (Filed Sub-Bid).
   5. Section 22 00 00 ***Plumbing (Filed Sub-Bid).
   6. Section 23 00 00 ***HVAC (Filed Sub-Bid).
   7. Section 26 00 00 *** Electrical (Filed Sub-Bid).
   8. Section 31 20 00 Earthwork.

1.04 SUBMITTALS

A. Materials order or manufacturer's data sheets.

1.05 REFERENCES

A. Class A, ASTM E 1745 Standard Specification for Water Vapor Retarders Used in Contact With Soil or Granular Fill Under Concrete Slabs.
B. ASTM E 96 - Water Vapor Transmission of Materials.
C. ASTM E 1643 - Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Reef Industries, Inc., PO Box 750250, Houston, TX 77275; 800-231-6074; www.reefindustries.com, or approved equal.

2.02 MATERIALS

A. Vapor retarder under concrete slabs: Reef Industries Griffolyn Type 65 G.
   1. Material: 4-ply laminate, combining 2 layers of high-density polyethylene and a high-strength non-woven cord grid with a layer of non-woven geotextile fiber.
   2. Weight, ASTM D 3776: 80 lb/1,000 sq. ft(39 kg/100 sq. meters).
   3. Puncture Propagation Tear, ASTM D 2582: 55 lb (245 N).
   4. Permeance, ASTM E 96: 0.038 grains/hr-SF-in Hg (2.18 ng/(Pa-s-sq. mtrs)).
   5. Drop Dart, ASTM D 1709: 2900 g.
   6. Tensile Strength, 3 Inches, ASTM D 882: 220 lb/1,220psi (980 N/8,270 kPa).
   7. Puncture Strength, ASTM D 4833: 102 lb (454 N).
   8. Classification, ASTM E 1745: Class A.
   9. Usable Temperature Range: -25 to 170 degrees F (-32 to 77 degrees C).

2.03 ACCESSORIES

A. Seam and repair tapes for vapor retarders under slabs:
   1. Mastic Tape: Griffolyn Fab Tape.
   2. Self-Adhesive Repair Tape: Griffolyn Griff-Tape.
B. Pipe Boots: Griffolyn pipe boots, field-fabricated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive reinforced vapor retarders. Notify Architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

A. Install reinforced vapor retarders in accordance with ASTM E 1643 and manufacturer's instructions.
B. Ensure subgrade beneath rigid insulation is smooth, level, and compacted with no sharp projections so that subsequent installation of vapor retarder above rigid insulation will not be at risk of shifting and separation.
C. Lap vapor retarder over rigid insulation and seal completely to footings and vertical foundation walls and steel columns.
D. Install vapor retarders continuously at locations under slabs. Ensure there are no discontinuities in the vapor retarder at seams and penetrations.
E. Install vapor retarders in largest practical widths possible to minimize seams.
F. Join sections of vapor retarder and seal penetrations in vapor retarder with mastic tape. Ensure vapor retarder surfaces to receive mastic tape are clean and dry.
G. Ensure there is no moisture entrapment by vapor retarder due to rainfall or ground water intrusion.
H. Immediately repair holes in vapor retarder with self-adhesive repair tape.
I. Seal around pipes and other penetrations in vapor retarder with pipe boots in accordance with manufacturer's instructions.

3.03 PROTECTION

A. Protect reinforced vapor retarders from damage during installation of rigid insulation, reinforcing steel, below slab utilities and during placement of concrete slabs.
B. Immediately repair damaged vapor retarder in accordance with manufacturer's instructions.

END OF SECTION

SECTION 07 27 00 – AIR BARRIERS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Air barrier system at infilled portions and reconfigured areas of exterior framed walls with terminations to foundation water proofing and roof as indicated in the Drawings. Work includes, but may not be limited to, the following:
      a. Adhesive/Primer
      b. Self-Adhered Water Resistive Air Barrier, vapor permeable
      c. Self-Adhered Water Resistive Flashing, vapor impermeable
      d. Sealant

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 03 30 00 Cast-in-Place Concrete.
   2. Section 04 43 00 Stone Masonry.
   3. Section 07 21 13 Board Insulation.
   4. Section 07 14 00 Fluid-Applied Waterproofing.
   5. Section 07 92 00 Joint Sealants.
   6. Section 07 60 00 Flashing & Sheet Metal.

1.04 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
   1. AAMA 711-13 - Voluntary Specification for Self-Adhering Flashing Used for Installation of Exterior Wall Fenestration Products
   2. AAMA 2400-02 - Standard Practice for Installation of Windows with a Mounting Flange in Stud Frame Construction
B. American Society for Testing and Materials (ASTM):
   1. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting
   2. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
   3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
   4. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials
   5. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen

6. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference
7. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
8. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials
9. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

1.05 SUBMITTALS

A. Refer to Section 01 33 00 – Submittal Procedures for information.
B. Product Data: Submit product data, including manufacturer's specifications, installation instructions, and general recommendations for air barrier applications.
   1. Air Barrier Manufacturer's guide specification.
   2. Air Barrier Manufacturer's complete set of technical data sheets for assembly.
   3. Air Barrier Manufacturer's complete set of guide details for assembly.
C. Test Reports: Submit for acceptance, complete test reports from approved independent testing laboratories certifying that air barrier system conforms to performance characteristics and testing requirements specified herein.
D. Submit manufacturer's Health Product Declarations (HPD) and Environmental Product Declarations (EPD) to the extent that they are available for the products.
E. Certificates: Produce certification confirming assembly components are supplied and warranted by a single source Air Barier Manufacturer.

1.06 QUALITY ASSURANCE

A. Single Source Responsibility:
   1. Obtain air barrier and auxiliary materials including adhesive/primer, air barrier, flashings, and sealants from a single Air Barrier Manufacturer regularly engaged in the manufacturing and supply of the specified products.
   2. Verify product compliance with federal, state, and local regulations.
B. Manufacturer Qualifications: Air Barrier Manufacturer shall demonstrate qualifications to supply materials of this Section by certifying the following:
   1. Air Barrier Manufacturer must not issue warranties for terms longer than they have been manufacturing and supplying specified products for similar Work.
C. Installer Qualifications:
   1. Perform Work in accordance with the Air Barrier Manufacturer's published literature and as specified in this Section.
   2. Maintain copy of the Air Barrier Manufacturer's installation instructions on site.
   3. At all times during the execution of the Work allow access to site by the Air Barrier Manufacturer representative.
   4. If meeting with the Air Barrier Manufacturer during project construction, contact the Air Barrier Manufacturer a minimum of two weeks prior to scheduled meeting.

1.07 MOCK-UPS

A. Mock-ups: Construct mock-ups to verify selections made under submittals and to set quality standards for materials and execution as follows:
   1. Where directed by Architect, construct typical exterior wall section, six and one-half (6.5) feet by six and one-half (6.5) feet, incorporating substrate materials, and adjacent materials including flashing, door frame, window frame, attachment of insulation and showing air barrier application details.
B. Notify Architect a minimum seven (7) days prior to mock-up construction.
C. Review and acceptance of mock-ups does not constitute approval of deviations from the Contract Documents contained in mock-ups unless Architect specifically notes such deviations in writing.

D. Once reviewed by Architect, acceptable mock-up can form a permanent part of the Work, and will form the basis for acceptance for the remainder of the project.
E. Remove and replace materials found unacceptable at no additional cost to Owner.

1.08 DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:
   1. Deliver materials to the jobsite in undamaged and clearly marked containers indicating the name of the Air Barrier Manufacturer and product.
B. Storage of Materials:
   1. Store materials as recommended by the Air Barrier Manufacturer and conform to applicable safety regulatory agencies. Refer to all applicable data including, but not limited to, Safety Data Sheet (SDS), Technical Data sheet (TDS), product labels, and specific instructions for personal protection.
   2. Keep solvents away from open flame or excessive heat.
   3. Store materials in original packaging.
   4. Protect rolls from direct sunlight until ready for use.
   5. Refer to Air Barrier Manufacturer's product TDS.
C. Handling:
   1. Refer to Air Barrier Manufacturer's product TDS.

1.09 SITE CONDITIONS

A. Environmental Requirements:
   1. Do not perform Work during rain or inclement weather.
   2. Do not perform Work on frost covered substrates or surfaces that are wet to touch.
B. Protection:
   1. It is the responsibility of the installing Subcontractor to protect all surfaces not included in scope of Work from overspray including, but not limited to, windows, doors, adjacent areas, and vehicles.
   2. Cap and protect exposed back-up walls against wet weather conditions during and after application of air barrier assembly.
C. Complete preparation Work prior to installing air barrier.
D. Ground all equipment during operations.

1.10 WARRANTY

A. Manufacturer's Single Source Warranty:
   1. Product Warranty: Manufacturer must warrant the material against product defect for a period of one (1) year from date of Substantial Completion as determined by the Architect.

1.11 PRE-CONSTRUCTION CONFERENCE

A. Following approval of submittals and prior to commencement of the Work, schedule a Pre-Construction Conference with the Owner, Architect, Contractor and Manufacturer's Representative to review all project conditions and details.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Air Barrier System components and accessories must be obtained as a single-source from the membrane manufacturer to ensure total system compatibility and integrity.
   1. Basis-of-Design: Henry Company: www.henry.com
   2. Grace Construction Products; GCP Applied Technologies; www.gcpat.com

3. Carlisle Coating & Waterproofing; www.carlisleccw.com

B. Manufacturer's system shall meet the following standards:
   1. Air leakage:
      a. ASTM E2357: Pass
      b. CAN/ULC-S742-11: Classification A1
      c. CAN/ULC S741-08
   2. Water resistance:
      a. AATCC TM127: Pass
      b. ASTM E331: Pass
   3. Nail Sealability:
      a. AAMA 711-13, ASTM D1970: Pass

2.02 MATERIALS

A. Primary Sheet-Applied, Vapor Permeable Water Resistive Air Barrier (Basis of Design):
   1. Self-adhered vapor permeable, water resistive air barrier consisting of a reinforced, modified polyolefin tri-laminate film surface and patented permeable adhesive technology with split-back poly-release film; having the following typical physical properties:
      a. Basis of design: Henry® Blueskin® VP160 Self-Adhered Water Resistive Air Barrier
      b. Color: Blue
      c. Thickness: 23 mils (0.58 mm)
      d. Water Vapor Permeance (ASTM E96): 29 perms
      e. Air Leakage of Air Barrier Assemblies (ASTM E2357): Pass
      f. Air Permeance (ASTM E2178): Pass
      g. Nail Sealability (ASTM D1970): Pass
      h. Dry Tensile Strength (ASTM D882):
         i. 41 lbf /182N MD
         ii. 29 lbf /129N CD
      i. Surface Burning Characteristics (ASTM E84):
         i. Flame Spread: Class A
         ii. Smoke Development: Class A
      j. Low Application Temperature: 20 degrees F (-7 degrees C)

B. Assembly Auxiliary Materials:
   1. Adhesives/Primers: Low VOC adhesive synthetic rubber based quick setting adhesive with low VOC content; having the following typical physical properties:
      a. Basis of design: Henry® Blueskin® LVC Adhesive
      b. Color: Blue
      c. Maximum VOC: <240 g/L
      d. Drying time (initial set): 30 minutes
      e. Low Application Temperature: 10 degrees F (-12 degrees C)
   2. Quick setting primers: Synthetic rubber based quick setting adhesive with low VOC content; having the following typical physical properties:
      a. Basis of design: Henry® Blueskin® LVC Spray Primer
      b. Color: Blue
      c. Maximum VOC: 250 g/L
      d. Dry time: 1-3 minutes
      e. Low Application Temperature: 40 degrees F (4.4 degrees C)
   3. Non-vapor permeable, self-adhered water resistive air and vapor barrier consisting of a synthetic butyl compound integrally laminated to a white engineered polypropylene film surface; having the following typical physical properties:
      a. Basis of design: Henry® Blueskin® Butyl Flash
      b. Color: White
      c. Thickness: 14 mils (0.36 mm)
      d. Water Vapor Permeance (ASTM E96): 0.14 perms

e. Nail Sealability (ASTM D1970): Pass
f. Elongation (ASTM D412): 825% minimum
g. Low Application Temperature: 25 degrees F (-4 degrees C)

4. Non-vapor permeable, self-adhered water resistive air and vapor barrier consisting of an SBS rubberized asphalt compound integrally laminated to a blue engineered thermoplastic film surface; having the following typical physical properties:
   a. Basis of design: Henry® Blueskin® SA Self-Adhered Water Resistive Air Barrier
   b. Color: Blue
   c. Thickness: 40 mils (1 mm)
   d. Water Vapor Permeance (ASTM E96): 0.86 perms
   e. Nail Sealability (ASTM D1970): Pass
   f. Elongation (ASTM D412-modified): 200% minimum
   g. Low Application Temperature: 41 degrees F (5 degrees C)
5. Building Envelope Sealant: Moisture cure, medium modulus polymer modified sealing compound; having the following typical physical properties:
   a. Basis of design: Henry® 925 BES Sealant
   b. Color: Varies
   c. Elongation: 450 – 550%.
6. Termination Sealant: One-part high performance synthetic rubber sealant; having the following typical physical properties:
   a. Basis of design: Henry® 212 All Purpose Crystal Clear Sealant
   b. Color: Clear
   c. Elongation: 200% minimum

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
   1. Verify substrates to receive Work and surrounding adjacent surfaces are in accordance with Air Barrier Manufacturer's installation guide and as specified in this Section prior to installation of self-adhered air barrier assembly.
   2. Continuous substrate:
      a. Existing substrate must be continuous and secured prior to application of air barrier.
      b. Securely fasten sheathing panels and install flush to ensure a continuous substrate in accordance with Air Barrier Manufacturer's installation guide and as specified in this Section.
      c. Fastener penetrations must be set flush with sheathing and fastened into solid backing.
      d. Refer to Air Barrier Manufacturer's details.
   3. Concrete surfaces shall be smooth and without large voids, spalled areas or sharp protrusions. Refer to Air Barrier Manufacturer's details for substrate gap limitations.
   4. Remove concrete forms and allow new concrete to cure for a minimum of fourteen (14) days.
   5. Curing compounds or release agents used in concrete construction must be resin based without oil, wax or pigments.
   6. Do not install air barrier over substrates that are wet to touch.
B. Notify Contractor in writing of any conditions that are not acceptable.
C. The installing contractor shall examine and determine that surfaces and conditions are ready to accept the Work of this Section in accordance with the Air Barrier Manufacturer's installation guide and as specified in this Section. Commencement of Work or any parts thereof shall mean installer's acceptance of the substrate.

D. Do not apply air barrier until substrate and environmental conditions are in accordance with Air Barrier Manufacturer's installation guide and as specified in this Section.

3.02 PREPARATION

A. All surfaces must be sound, dry, clean, and free of oil, grease, dirt, excess mortar, frost, laitance, loose and flaking particles, or other contaminants.
B. Protect adjacent surfaces not included in scope of Work to prevent spillage and overspray.
C. Cap and protect exposed substrate against wet weather conditions during and after application of the air barrier assembly.

3.03 INSTALLATION

A. Ensure substrate is ready to receive air barrier in accordance with Air Barrier Manufacturer's installation guide and as specified in this Section.
B. Temperature limitation:
   1. Primary air barrier:
      a. Substrate temperature must be above 20 degrees F (-7 degrees C) and rising.
   2. Auxiliary products:
      a. Temperature limitations may vary. Refer to Air Barrier Manufacturer's product TDS for product specific temperature limitations.
C. Application of flashing:
   1. Self-adhered flashing:
      a. Where required install adhesive/primer recommended by Air Barrier Manufacturer continuously at rate recommended ensuring complete substrate coverage of anticipated flashing installation area.
         i. Allow adhesive/primer to cure to a tacky film prior to application of flashing.
         ii. Primed areas not covered by end of day must be re-primed prior to installation of flashing.
      b. Measure and cut self-adhered flashing to ensure adequate length to achieve continuous coverage of desired installation.
      c. Peel protective film from self-adhered flashing and align top of membrane verifying proper positioning prior to complete film removal and flashing placement.
      d. Press self-adhered flashing firmly into place by applying hand pressure to the middle of the membrane and working the pressure to the edges; eliminating wrinkles and air bubbles.
      e. Install self-adhered flashings in shingle fashion to eliminate reverse laps.
      f. Where required, prime laps at rate recommended by Air Barrier Manufacturer to ensure complete coverage of anticipated lap installation.
      g. Lap adjoining edges a minimum of two (2) inches.
      h. Roll flashing and laps with countertop roller to obtain thorough adhesion.
      i. Seal reverse laps at self-adhered flashing with sealant. Sealant recommendations may vary due to product or sequence of construction. Refer to Air Barrier Manufacturer details for recommended sealant.
D. Detailing/Flashing:
   1. Complete detailing and flashing installations per Air Barrier Manufacturer's installation guide, details, and this specification.
   2. Refer to Air Barrier Manufacturer details for further clarification and installation procedures including, but not limited to, the following:
      a. Inside corners
      b. Outside corners
      c. Pipe penetrations
      d. Shelf angles
      e. Wall to foundation transitions

f. Reverse laps
g. Construction joints
h. Rough openings: Install rough opening details per Window Manufacturer's installation guide details and in accordance with ASTM E2112.

3. Transitions: Contact Air Barrier Manufacturer to coordinate transition of self-adhered air barrier to adjacent areas including, but not limited to, the following:
   a. Roof to air barrier
   b. Air barrier to vertical or horizontal waterproofing
   c. Fastener penetrations

E. Application of Primary Sheet-Applied Vapor Permeable Water Resistive Air Barrier:
1. Where required, install adhesive/primer recommended by Air Barrier Manufacturer continuously and at rate recommended by Air Barrier Manufacturer to ensure complete substrate coverage of anticipated flashing installation area.
   a. Allow adhesive/primer to cure to a tacky film prior to application of air barrier.
   b. Primed areas not covered by end of day must be re-primed prior to installation of air barrier.
2. Peel protective film from primary air barrier and align top of verifying proper positioning prior to complete film removal and placement.
3. Press primary air barrier firmly into place by applying hand pressure to the middle of the membrane and working the pressure to the edges; eliminating wrinkles and air bubbles.
4. Install primary air barrier in shingle fashion to eliminate reverse laps.
5. For lap adhesion enhancements, install low VOC adhesive continuously and at rate recommended by Air Barrier Manufacturer to ensure substrate coverage of anticipated flashing installation area.
   a. Allow adhesive/primer to cure to a tacky film prior to subsequent primary air barrier installation.
6. Horizontal applications:
   a. Horizontal seams: two (2) inch minimum.
   b. Vertical seams: three (3) inch minimum.
7. Roll primary air barrier and laps with countertop roller to obtain thorough adhesion.
8. Seal permanent reverse laps of primary air barrier with termination sealant.

F. Fastener Penetrations Through Primary Air Barrier:
1. It is the responsibility of the installer penetrating the air barrier assembly to install fasteners and components in accordance with the Air Barrier Manufacturer's installation guide and as specified in this Section.
2. Installation requirements:
   a. Drill fasteners and components with sufficient compression to maintain continuity in the air barrier assembly.
   b. Refer to "Self-tapping fasteners" and/or "Pre-drilled fasteners".
3. Supplemental sealant:
   a. Penetrations that do not meet installation requirements require the addition of termination sealant at point of insertion through the air barrier to maintain continuity in the air barrier assembly.
4. Self-tapping fasteners:
   a. Fastener head/assembly component must be larger in diameter than the fastener shank.
   b. Install fastener head/assembly component to provide a continuous compression firmly against the air barrier creating a gasketing seal without damaging the membrane.
   c. Do not install fastener components through the air barrier over unsupported areas of the substrate such as sheathing joints.
   d. Remove overdriven fasteners, improperly installed fasteners, defective/broken fasteners, or fasteners not properly fastened into the building structure beyond the air barrier membrane and seal the vacated hole with termination sealant prior to the installation of the exterior cladding.

5. Pre-drilled fastening assemblies:
    a. Fastening head/assembly component must be larger in diameter than predrilled hole.
    b. Install fastening head/assembly component to provide a continuous compression firmly against the air barrier creating a gasketing seal without damaging the membrane.
    c. Do not install fastening components through air barrier over unsupported areas of the substrate such as sheathing joints.
    d. Seal improperly drilled and/or vacated holes with termination sealant prior to the installation of the exterior cladding.

3.04 FIELD QUALITY CONTROL

A. Final Observation and Verification:
    1. Air Barrier Manufacturer shall complete the final inspection of the air barrier assembly as required by warranty.
        a. Contact Air Barrier Manufacturer for warranty issuance requirements.
B. Install cladding as soon as practical after application. Air barrier assembly not designed for permanent UV exposure. Refer to Air Barrier Manufacturer's product TDS for product limitations.

3.05 CLEANING

A. As the Work proceeds, and upon completion, promptly clean up and remove from the premises all rubbish and surplus materials resulting from the foregoing Work.
B. Clean soiled surfaces, spatters, and damage caused by Work of this Section.
C. Check area to ensure cleanliness and remove debris, equipment, and excess material from the site.

END OF SECTION

SECTION 07 46 23 - WOOD SIDING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not limited to the following:
   1. Provision of beveled wood clapboard siding at exterior walls where indicated.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 04 43 00 Stone Masonry.
   2. Section 06 10 00 Rough Carpentry.
   3. Section 06 20 13 Exterior Finish Carpentry.
   4. Section 07 21 13 Board Insulation.
   5. Section 07 27 00 Air Barrier.
   6. Section 07 60 00 Flashing & Sheet Metal.
   7. Section 07 92 00 Joint Sealants.
   8. Section 08 11 00 Metal Doors and Frames.
   9. Section 08 14 00 Wood Doors.
   10. Section 08 52 00 Wood Windows.
   11. Section 08 90 00 Louvers & Vents.
   12. Section 09 90 00 ***Painting & Coating (Filed Sub-Bid).
   13. Section 22 00 00 ***Plumbing (Filed Sub-Bid).
   14. Section 23 00 00 ***HVAC (Filed Sub-Bid).
   15. Section 26 00 00 ***Electrical (Filed Sub-Bid).

1.04 SUBMITTALS

A. Submit for approval samples, product data.
B. Submit installation instructions for each product.
C. Submit mockup panels of 4’ x 4’ size for each siding type with finish applied.
D. Provide manufacturer’s Health Product Declarations (HPD’s) and Environmental Product Declarations (EPD’s) for the specified materials if available.
E. Provide certification from the Forest Stewardship Council (FSC) that wood products have been harvested responsibly from well-managed forests.

1.05 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Wood Clapboard Siding: White cedar bevel siding, grade “A & Better” for paint finish; all heartwood, radially cut.
   1. 1/2” x 6” with profile and coursing to match existing as shown on the Drawings.
B. Fasteners: stainless steel nails of sufficient length to penetrate the underlying strapping 3/4” minimum or full penetration.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine substrate; report unsatisfactory conditions in writing. Beginning work means acceptance of substrates.
B. Install materials and systems in accordance with manufacturer's instructions, approved submittals and as required by the drawings. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
C. Clapboards shall be primed under the work in Section 09 90 00 Painting and Coatings. All wood siding must be fully primed prior to installation.
D. Confirm installation of continuous substrate for secure attachment of wood siding.
E. Confirm installation of air barrier system and flashings in accordance with manufacturer’s instructions prior to installation of siding. All openings and transitions must be fully sealed and the air barrier system completed prior to installation.

3.02 INSTALLATION OF CLAPBOARD SIDING

A. Follow installation instructions specified in the Western Red Cedar Lumber Association's publication, “How to Install Cedar Siding” for bevel siding, outside / inside corners, and field joints. For printed manual refer to Western Red Cedar Lumber Association (WRCLA), 1501-700 West Pender, Vancouver, BC V6C 1G8; 866-778-9096; www.wrcla.org.
B. Coordinate work with related trades; scribe and cope siding boards for accurate fit. Allow installation of related work to avoid cutting and patching.
C. Select siding boards of longest possible lengths. Discard boards that are warped, twisted, bowed, crooked or otherwise defective.
D. Double the starting course at the base of the wall and maintain constant thickness of clapboards throughout the installation.
E. Install bevel siding with smooth side facing out for receipt of finish coatings.
F. Replace any damaged components. Clean and protect work from damage.

END OF SECTION

SECTION 07 60 00 - FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials (except as noted) and equipment necessary to complete the Work of this Section, including but not limited to the following:
   1. Provide copper valley and eave flashings at roof to infill area of chimney removal.
   2. Fabricate copper sill pan for window opening where noted to replace existing door in east wall.
   3. Fabricate copper sill pans at louvers for ERV intake and exhaust.
   4. Fabricate copper head flashings for louvers and new window and door openings.
   5. Fabricate copper drip head flashings for wood setting blocks at penetrations for items that will include, but not necessarily be limited to, exterior power outlets, portable generator plug, fire alarm bell, hose bibs, cardkey access pads and similar devices that will mounted to the face of exterior siding surfaces. Installation of drips shall be under Section 06 20 13 – Exterior Finish Carpentry.
   6. Miscellaneous flashings and other items as indicated on the Drawings or required by the Work.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this Section. Other Sections that relate directly to work of this Section include, but are not limited to the following:
   1. Section 04 43 00 Stone Masonry.
   2. Section 06 10 00 Rough Carpentry.
   3. Section 06 20 13 Exterior Finish Carpentry.
   4. Section 07 27 00 Air Barrier.
   5. Section 07 46 23 Wood Siding.
   6. Section 07 92 00 Joint Sealants.
   7. Section 08 11 00 Metal Doors & Frames.
   8. Section 08 14 00 Wood Doors.
   9. Section 08 52 00 Wood Windows.
   10. Section 08 90 00 Louvers & Vents.
   11. Section 22 00 00 ***Plumbing (Filed Sub-Bid).
   12. Section 23 00 00 ***HVAC (Filed Sub-Bid).
   13. Section 26 00 00 ***Electrical (Filed Sub-Bid

1.04 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Specialist.
   1. The term "Specialist" as used in this specification shall mean an individual or firm of established reputation for performance of work of highest quality, or, if newly organized, whose personnel have previously established a similar reputation in the same field, which is regularly engaged in, and which maintains a regular

force of workman skilled in either manufacturing or fabricating items required by the Contract, installing items required by the Contract, or otherwise performing work required by the Contract.

2. The Specialist shall demonstrate previous successful trade work with the installation and repair of similar copper sheet metal work and flashings of at least three comparable buildings.

B. The Specialist shall coordinate all flashing and metal work with all associated work specified under other Sections. Coordinate work of this Section with other work for proper sequencing of each installation and use of scaffolding. Ensure best possible weather resistance and durability of the work and protect all interior and exterior materials and finishes.

C. Work shall only be performed when weather is dry and weather reports call for a continuation of dry weather. Specialist shall fully cover unfinished work as required to provide full weather protection and shall be held responsible for any and all damage to the existing building, its finishes and furnishings resulting from or caused by the work of this Section. The Specialist shall coordinate the work of all trades to ensure a weathertight and complete installation.

D. Deliver and store all materials so as not to damage. Store materials in locations designated by the Owner. Provide protection as required during storage.

E. The Specialist shall take all necessary field measurements prior to fabrication and installation of work and shall assume complete responsibility for accuracy of same.

1.05 WARRANTY

A. Provide a written warranty against all defects in materials and workmanship, including but not limited to leakage, cracking, pitting and splitting, for all the work of this Section for a period of two (2) years from acceptance of completed work.

1.06 SUBMITTALS

A. General: Submit the following according to Section 01 33 00 Submittal Procedures.

1. Product data for each type of product specified. Submit manufacturer's detailed technical product data, installation instructions and recommendations, including necessary data to document that materials comply with requirements.
2. Samples for verification purposes of each type of materials required.
3. Shop Drawings for all copper fabrications.
4. Samples of downspout clamps and fastening system.
5. Highlight any proposed variations between the shop drawings and profiles noted in the Drawings.

B. Material Safety Data Sheets (MSDS) for each material used.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Revere Copper Products, Inc.; One Revere Park; Rome NY 13440-5561; http://www.reverecopper.com , or approved equal.

2.02 SHEET METAL FLASHING AND TRIM MATERIALS

A. Copper for Roofing and Flashing:

1. Red Copper shall be cold-rolled sheet or coil; soft temper if required for forming; 16-ounce or in weight indicated on the drawings; ASTM B 370.

B. Nails for fastening sheet metal to wood - brass or copper, of "stronghold" type, with large flat heads, annular rings, and needle points, no smaller than No. 12 stub gauge and of sufficient length to penetrate the wood blockings, nailers, etc., not less than

7/8" long, but not so long that they penetrate through the underside of the roof or trim boarding. Nails for fastening to masonry shall be non-corrosive; choice of fasteners shall be determined by field tests at existing substrate.

C. Screws, bolts, and other accessories used for fastening sheet metal to wood or to non-ferrous metals shall be brass or copper, and shall be equipped with soft neoprene self-sealing washers.
D. Solder composition - 50% block tin and 50% pig lead, and shall conform to ASTM specifications B32.
E. Flux shall be rosin core or muriatic acid killed with zinc. All acid is to be thoroughly washed off after soldering is completed.
F. Wedges for flashing - rolled from 2 1/2 lb. lead sheets.
G. Butyl sealants – Pecora BA-98 non-hardening butyl for concealed setting beds (for base flashings and sill pans) and for joints between copper sheets; Pecora BC-158 butyl rubber sealant (black) for exposed locations, including joint between copper downspouts and cast iron boots. DO NOT USE SILICONE SEALANTS IN CONTACT WITH OR IN CLOSE PROXIMITY TO COPPER FLASHINGS.

PART 3 - EXECUTION

3.01 INSPECTION AND ACCEPTANCE

A. Reference Standards. Except as otherwise indicated, comply with manufacturer`s installation instructions and recommendations, and with "Copper and Common Sense" by the Revere Copper and Brass Co. Inc., and with "Sheet Copper Applications" by the Copper Development Association Inc., 405 Lexington Ave., New York, N.Y. 10174.
B. Surface Preparation:
   1. Inspect work performed by others, including substrate conditions, prior to installation. Report any unacceptable conditions to the General Contractor.
   2. Separate dissimilar metals from immediate contact with coatings or separation sheets appropriate for permanent separation of the metal surfaces.
C. Fabrication and Installation:
   1. Copper Installation: Install sheet metal and flashing as indicated and in compliance with details and recommendations of the manufacturer.
   2. Shop fabricate work. Corners shall be mitered with flat lock seams and neatly soldered.
   3. Anchor units of work securely in place by methods indicated or as recommended by manufacturer, providing for thermal expansion of metal units. Conceal all fasteners where possible using copper cleats and concealed nails. Do not face nail.
   4. Install work with laps, joints and seams that will be permanently watertight and weatherproof, and shall be without waves, buckles, or distortion. All components to be soldered shall be tinned around and on both sides twice the width of the lock seam to be used.
D. Sheet copper shall not be installed in contact with or in close proximity to fire retardant lumber or other fire retardant building materials. Refer to the manufacturer’s specifications and warranties, for use with special types of exterior fire retardant treatments.

END OF SECTION

SECTION 07 84 13 – PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Provide penetration firestopping where required at rated assemblies including partitions and floor/ceiling systems.
      a. Penetration firestopping shall be performed by the General Contractor unless noted in the Sections for specific trades where it is assigned to that trade.
   2. Provide firesafing insulation at floor, wall and ceiling penetrations.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 06 10 00 Rough Carpentry.
   2. Section 06 20 23 Interior Finish Carpentry.
   3. Section 07 21 16 Blanket Insulation.
   4. Section 07 92 00 Joint Sealants.
   5. Section 09 21 16 Gypsum Board Assemblies.
   6. Section 09 30 00 Tiling.
   7. Section 09 90 00 ***Painting & Coating (Filed Sub-Bid).
   8. Section 22 00 00 ***Plumbing (Filed Sub-Bid).
   9. Section 23 00 00 ***HVAC (Filed Sub-Bid).
   10. Section 26 00 00 ***Electrical (Filed Sub-Bid).

1.04 SUBMITTALS

A. Submit for approval samples, product data and performance characteristics.
B. Submit installation instructions.

1.05 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

1.06 ENVIRONMENTAL CONDITIONS

A. In cold weather, installation of penetration fireproofing shall not begin until the building is fully enclosed, with permanent HVAC system in operation, and building temperatures maintained above 40-degrees F. Maintain minimum surface, water, mix and air temperature of 40-degrees F during application. Temperature of

substrate should not exceed those found typically in domestic water systems (140-degrees F).

B. Provide adequate ventilation to carry off excess moisture. Do not apply materials to moist surfaces or areas continuously immersed in water.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Firestopping Sealant:
   1. USG Firestop System Mortar-Type Sealant: FIRECODE COMPOUND, or approved equal. Meets ASTM E814, UL 1479 and UL 2079.
   2. Vinyl-type non-asbestos formulation.
   3. Surface burning characteristics: Flame Spread 0, Smoke Developed 0.
   4. Color: red.
   5. Working Time: approximately 75 minutes.
   6. Setting Time: 2-3 hours.
   7. Freezing Sensitivity: none after set.

B. Firestopping Forming Material:
   1. USG Firestop System Forming Material: THERMAFIBER SAFING INSULATION, or approved equal. Meets ASTM C665, Type I; ASTM E136; Noncombustible by NFPA Standard 220.
   2. High-melt mineral fiber insulation material.
   3. Surface burning characteristics: Flame Spread 15, Smoke Developed 0.
   4. Nominal Density: 4.0 pounds per cubic foot.
   5. Size: 4” thick, 24” wide, 48” long.
   6. Application Method: friction fit.
   7. Freezing Sensitivity: none.

C. Other Approved Manufacturers:
   1. Hilti Corporation, http://www.hilti.com.
   2. 3M Company, http://www.3m.com.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install materials and systems in accordance with manufacturer's printed instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance.

B. Clean substrate of dirt, dust, grease, oil, efflorescence, loose material or other matter. With a serrated knife, cut safing insulation slightly wider than the opening. Compress and tightly fit minimum 2.5” or 3” thickness of insulation with nominal density of 4 PCF completely around the penetrant.

C. Mix FIRECODE Compound according to directions on package. Using a trowel, putty knife or spatula, scoop the compound from container and work into the penetration opening. Apply compound to minimum 1/2” or 1” thickness, depending on assembly rating and instructions, on top of safing insulation. Ensure that compound is in contact with all surfaces and that entire opening is filled with safing and compound.

D. Cure and protect fireproofing as directed by manufacturer. Replace or restore damaged systems. Clean adjacent surfaces to remove spillage.

E. In finished areas, sand fully cured compound flush with adjacent surface and leave ready for painting by others.

END OF SECTION

SECTION 07 92 00 – JOINT SEALANTS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Waterstops at construction joints in concrete as follows:
      a. Between top of footing and bottom of foundation wall.
      b. Between top of foundation wall and bottom of concrete stem wall.
      c. Vertical construction joints in foundation and stem walls.
      d. At elevator pit between footings and walls, walls and slab.
   2. Horizontal joint filler and sealants at exterior paving and similar locations between dissimilar material or as noted.
   3. Building envelope sealants and joint fillers at modified areas due to renovation scope, including but not limited to:
      a. Penetrations of piping, conduits and utilities through concrete walls.
      b. Penetrations of piping, conduits and utilities through wood walls.
      c. Interior and exterior full perimeter seals at door and window frames to rough openings as shown to integrate with air barriers, sill pans and flashings.
      d. Perimeter of door and window frames between exterior casings and siding, and between interior casing and frame or extension jambs. (Do not place sealant at exterior joint between underside of head casing and frame.)
      e. Intersection of siding to corner boards, casings, transom bars, soffits, rakes, setting blocks and any similar abutments to siding.
   4. Installation of copper sill pans, flashings and sealants to adjacent materials for items fabricated by Section 07 60 00 Flashing and Sheet Metal:
      a. Copper sill pans at replicated window and ERV louvers.
      b. Copper head flashings for replicated window and new door openings.
   5. Sealants specified under Section 07 27 00 Air Barriers as part of the total system assembly for a completed air barrier system and as detailed in the Drawings.
   6. Intersections of dissimilar interior finishes, fixtures and other components:
      a. Perimeter of concrete slab on grade at intersection with foundation wall, column footings, elevator framing sills, and saw-cut control joints.
      b. Joints between gypsum wallboard and wood trim, hollow metal door frames, stair stringers and built-in casework (cabinets, counters, backsplashes).
      c. Sanitary caulking between toilet fixtures and finished wall, floor and counters.
      d. Joint between ceramic tile and mirrors; mirror and wood trim frame.
      e. Joint between ceramic tile chair rail and gypsum wallboard.
      f. Joint between ceramic tile and door frame.
   7. Sill seals between top of concrete walls and anchored wood sills.
   8. At all other locations where sealants are indicated in the Drawings and are not assigned to other Divisions of Work due to sequencing and responsibilities.
B. Sealants at the following locations will be provided by other Divisions due to the integral nature of the Work at the time of installation:
   1. Sealant integral to installation of roofing infill at chimney removal shall be provided as part of the work the roofer.

2. Acoustical and fire sealant under metal wall stud tracks to be provided under the work of Section 09 21 16 Gypsum Board Assemblies.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 03 30 00 Cast-in-Place Concrete.
   2. Section 04 43 00 Stone Masonry.
   3. Section 06 20 13 Exterior Finish Carpentry.
   4. Section 06 20 23 Interior Finish Carpentry.
   5. Section 06 61 19 Quartz Surfacing Fabrications.
   6. Section 07 14 00 Fluid-Applied Waterproofing.
   7. Section 07 16 16 Crystalline Waterproofing.
   8. Section 07 27 00 Air Barriers.
   9. Section 07 60 00 Flashing and Sheet Metal.
   10. Section 08 11 00 Metal Doors and Frames.
   11. Section 08 14 00 Wood Doors.
   12. Section 08 52 00 Wood Windows.
   13. Section 08 80 00 Glazing.
   14. Section 08 90 00 Louvers and Vents.
   15. Section 09 21 16 Gypsum Board Assemblies.
   16. Section 09 30 00 Tiling.
   17. Section 09 90 00 ***Painting and Coating (Filed Sub-Bid).
   18. Section 14 26 00 ***LU/LA Elevator (Filed Sub-Bid).
   19. Section 22 00 00 ***Plumbing (Filed Sub-Bid).
   20. Section 23 00 00 ***HVAC (Filed Sub-Bid).
   21. Section 26 00 00 ***Electrical (Filed Sub-Bid).
   22. Section 32 13 13 Exterior Concrete.

1.04 SUBMITTALS

A. Submit for approval samples and product data.
B. Submit actual samples of sealant material for color selection. Color brochures or charts will not be acceptable.
C. Submit installation instructions for each type of joint sealer.
D. Submit results of field adhesion tests for review and approval prior to application.

1.05 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 MATERIALS – JOINT SEALERS

A. Joints designed for expansion and movement conditions at site:
   1. Exterior exposed vertical or horizontal joints: Tremco Spectrem 3 or 4 integrally colored silicone sealant or approved equal.
   2. Perimeter of Exterior Door and Window Frames: Tremco Spectrem 3 or 4 integrally colored silicone sealant or approved equal.
   3. Concealed sealant in contact with copper: See Section 07 60 00 – Flashing and Sheet Metal for butyl sealant; do not use silicone products with copper.

4. Interior joints at abutment of adjacent materials: general purpose, high performance, single component paintable acrylic latex: Tremco, Tremflex 834 or approved equal.
5. Exterior horizontal paving joints: semi-self-leveling (up to 10% slope) multi-component polyurethane in standard color; Tremco THC 901 or approved equal; field sanded in areas of granite stone flooring surfaces at control joints.
6. Joint filler: Resilient, pre-molded asphalt impregnated fiberboard.
7. Primers, bond breakers, and backer rods shall be compatible with the sealant and adjacent surfaces.

B. Sill Seals: Ribbed polyethelene closed cell foam 5 ½" x 3/16" as manufactured by one of the following, or an approved equal:
   a. Owens Corning; 800-GET-PINK; www.insulation.owenscorning.com
   b. Insulation Corp of America; 610-791-4200; www.insulationcorp.com
   c. Reflectix Inc; 765-533-4332; www.reflectixinc.com

2.02 MATERIALS – WATERSTOPS

A. A 15 mm X 10 mm flexible hydrophilic sponge rubber strip composed of vulcanized rubber and urethane polymer as the hydrophilic agent. The product shall develop no more than 0.03 MPa expansion pressure when fully hydrated. The product shall be NSF Certified for potable water use and shall meet the minimum performance requirements as shown in the following table:

PROPERTY	METHOD	KBA – 1510 FP
Hardness Hs	ASTM D 2240	HsC 22
Tensile Strength (MPa)	ASTM D 412	0.80
Elongation (%)	ASTM D 412	350
Specific Gravity	ASTM D 792	0.60
Volume Expansion (%)	In House	30

B. Manufacturer and Products: "Adeka Ultra Seal" Waterstops by Asahi Denka Kogyo K.K. distributed by OCM, Inc.; pre-formed rubber, paste type, and liquid types complying with the following, or an approved equal by Henry, Grace or Tremco:
   1. Waterstop between cold/construction joints, piping penetrations under 24-inch diameter, KBA-1510 FP.
   2. Waterstop for crack repair, precast joints, piping penetrations, cold/construction joints, expanded metal forms, sheet pile interlock, used on rough concrete in conjunction with KBA-1510 FP, Paste Type P-201 or gun grade.

PART 3 - EXECUTION

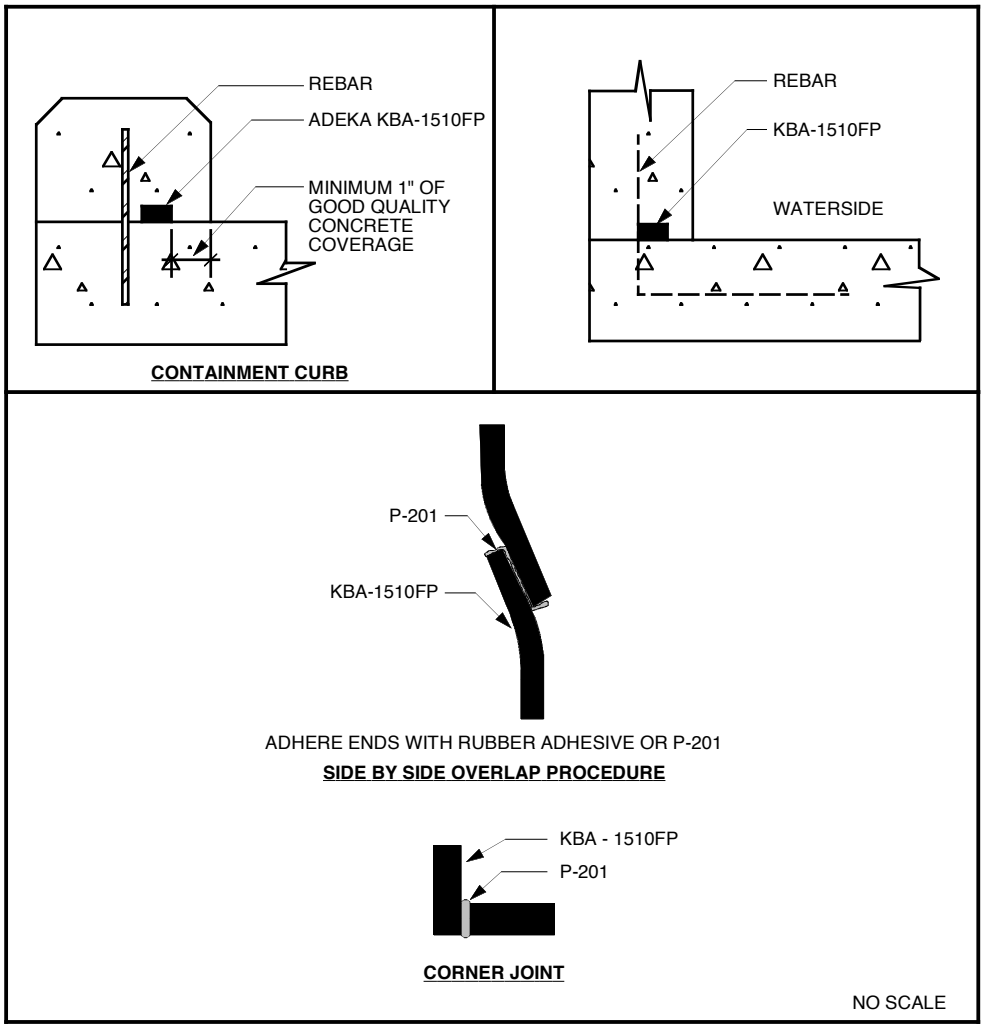
3.01 INSTALLATION – GENERAL

A. Examine substrate; report unsatisfactory conditions in writing. Beginning work means acceptance of substrates.
B. Provide exposed joint sealers in colors as selected the Architect from manufacturer's standards.
C. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
D. Clean and prime joints, and install bond breakers, backer rods and sealant as recommended by manufacturers.
E. Depth shall equal width up to 1/2" wide; depth shall equal 1/2 width for joints over 1/2" wide.

F. At each type of joint sealer application, perform a field adhesion test in accordance with methods prescribed by the manufacturer. Do not commence with application of joint sealers until a successful test has been performed and the results have been submitted to the Architect for review.
G. Do not expose raw edge of self-adhering air barrier into direct contact with sealant due to discoloration of the sealant that will result. Avoid contact during installation or provide bond breaker tape over the raw edge.
H. Cure and protect joint sealers as directed by manufacturers.
I. Notify General Contractor when sealants that will be painted have cured sufficiently for receipt of paint.
J. Replace damaged joint sealers. Clean adjacent surfaces to remove spillage.

3.02 INSTALLATION – WATERSTOPS

A. Examine substrate; report unsatisfactory conditions in writing. Beginning work means acceptance of substrates.
B. Place a small bead of Adeka Ultra Seal P-201 on any rough or scarred area prior to attaching KBA-1510FP.
C. Attach KBA-1510FP to the concrete or adjacent parged edge of masonry by one of the following methods:
   1. Attach with nails or concrete screws placed every 10" ~ 12" (approximately).
   2. If the concrete is rough, apply P-201 prior to attaching KBA-1510FP.
   3. If the concrete is smooth, clean and dry, apply one of the following prior to attachment:
      a. Adeka Ultra Seal P-201
      b. 3M-2141 Rubber Adhesive.
      c. Bostik 1142M Rubber Adhesive.
      d. Hilti CA 3200 Adhesive.
D. Site conditions may warrant the use of a combination of attachment methods.
   1. Use P-201 on all corner joints and parallel splices.
   2. Overlap parallel splices 2” and apply P-201 at ends and between adjacent stripes of KBA-1510FP.
E. Keep KBA-1510 FP taut and flat against the concrete during the attaching process. Do not allow any gaps between the concrete and the KBA-1510FP.
F. KBA-1510FP must be placed on the water side of rebar. The required concrete coverage varies depending on concrete strength, but a 1” minimum must be provided in all instances. Greater coverage allows for concrete of lesser PSI. For complete coverage information see manufacturer’s Coverage Chart or call 800.999.3959.
G. Protect waterstops from damage prior to and during installation of abutting concrete.
H. Placement of waterstops shall follow Manufacturer’s printed installation instructions, a sample of which is enclosed herein in illustration form.



END OF SECTION

SECTION 08 11 00 – METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Steel Door Frames, Sidelights and Borrowed Light Frames.
   2. Steel Louvers for Ventilation at Selected Interior Wood Door (No. 0.05).

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 06 10 00 Rough Carpentry.
   2. Section 06 20 23 Interior Finish Carpentry.
   3. Section 08 14 00 Wood Doors.
   4. Section 08 71 00 Door Hardware.
   5. Section 08 80 00 Glazing.
   6. Section 09 21 16 Gypsum Board Assemblies.
   7. Section 09 30 00 ***Tiling (Filed Sub-Bid).
   8. Section 09 90 00 ***Painting and Coating (Filed Sub-Bid).
   9. Section 23 00 00 ***HVAC (Filed Sub-Bid).

1.04 SUBMITTALS

A. Submit for approval product data, warranty information and construction details.

1.05 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Interior Door Frames and Sidelights: Cold-rolled steel frames as follows:
   1. 16 gauge, factory primed.
   2. Fully welded; mitered corners.
   3. Finish: Rust-inhibiting primer on steel doors and frames, shop applied; provide asphalt emulsion sound-deadening coating on concealed surfaces of frame.

4. Borrowed Light Frames: fully welded, mitered corners, applied glazing stops.

B. Exterior Door Frames:
   1. 16 gauge, galvanized, thermally broken.
   2. Fully welded; mitered corners.
   3. 3-sided vinyl thermal break per ASTM C1363.

C. Standard Door Louvers: Cold-rolled steel frame and blades.
   1. 18 gauge frame and blades.
   2. Mitered and welded corners.
   3. Reverse “Y” blades at one-inch increments for blocked vision.
   4. Free flow area at 43%.
   5. Single-side mounting with fasteners on room side of door.
   6. Finish: dark bronze powder coat.

D. Manufacturers shall include Steelcraft, Curries, Ceco Door, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Fabricate all work to be rigid, neat and free from seams, defects, dents, warp, buckle, and exposed fasteners. Install doors and frames in compliance with SDI-100, NFPA 80, and requirements of authorities having jurisdiction.

B. Provide secure attachment at perimeter of framed openings in partitions.

C. Hardware: Prepare doors and frames to receive hardware on final schedule.
   1. Provide for 3 silencers on single door frames. Provide for 2 silencers at head of frames for pairs of doors. Omit silencers where weather-stripping or sound seals are specified.
   2. Provide reinforcement plates in frames as required for hardware application.
   3. Prior to ordering frames, coordinate selected door hardware with manufacturers to confirm suitability and insure proper cutouts and reinforcing.

D. Shop Finish:
   1. Clean, treat and prime paint all work with rust-inhibiting primer comparable with finish paint specified in Section 09 90 00 Painting and Coating.
   2. Exterior galvanizing shall conform to ASTM A 653, 0.60 ounces per square foot.

E. Touch-up damaged coatings and leave ready to receive finish painting.

END OF SECTION

SECTION 08 14 00 – WOOD DOORS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Interior wood doors.
   2. Interior wood door frames.
   3. Modifications to existing interior wood frames.
   4. Repairs to existing wood doors and frames to accommodate hardware changes.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 00 31 19 Existing Conditions.
   2. Section 02 41 00 Demolition.
   3. Section 06 10 00 Rough Carpentry.
   4. Section 06 20 13 Exterior Finish Carpentry.
   5. Section 06 20 23 Interior Finish Carpentry.
   6. Section 08 52 00 Wood Windows.
   7. Section 08 11 00 Metal Doors & Frames.
   8. Section 08 71 00 Door Hardware.
   9. Section 08 80 00 Glazing.
   10. Section 07 92 00 Joint Sealants.
   11. Section 09 90 00 ***Painting & Coating (Filed Sub-Bid).

1.04 SUBMITTALS

A. Submit for approval product data, warranty information, construction details, elevations, door types, material samples, veneer characteristics and factory finish specifications.
B. Submit test data for fire-rated doors.

1.05 WARRANTY

A. Custom Stile-and-Rail Doors: one-year minimum warranty.
B. Flush and Stock Doors: lifetime warranty or manufacturer's standard.

1.06 DELIVERY AND HANDLING

A. Protect doors during transit, storage and handling to prevent soiling and damage.
B. Prior to delivery, building shall be completely enclosed and dry. Conform to AWI requirements for environmental conditions. HVAC system shall be fully functional to regulate interior temperatures.

C. Store doors at least four inches above the floor on a flat, level surface in a clean, dry, well ventilated area.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Interior Custom Doors and Frames:
   1. Custom wood stile-and-rail panel doors with 1/4'' veneer faces over lumber stave core; clear pine or fir for painted doors, or match existing wood specie and graining if to be stained (Third Floor); AWI premium grade.
      a. Flat panels where noted in the schedule and details to match existing.
      b. Raised panels where noted in the schedule and details to match existing.
      c. Panel mouldings to match existing profiles as detailed.
   2. Interior Custom Wood Frames: Solid lumber, match material of door.
   3. Glazing Frames & Muntins/Bars: Solid lumber, in profiles and configurations indicated on the Drawings; materials to match door.
   4. Finishing: Painted doors shall be factory primed on all six sides for full coverage. Primer shall be high quality alkyd coating. Interior stained doors shall be pre-finished in color to be selected from manufacturer's standards to match existing.

B. Interior Flush Doors:
   1. Fire-Rated Doors: Mineral core flush wood doors with SLC bonded core/edge interface and paint grade birch faces.
   2. Non-Rated Doors: Five or seven ply solid lumber core with SLC bonded core/edge interface and paint grade birch faces.
   3. Finishing: Interior flush doors shall be factory primed on all six sides for full coverage. Primer shall be high quality alkyd coating.
   4. Acceptable manufacturers include Weyerhauser, Eggers, Algoma or equal.

C. Glazing Frames & Stops:
   1. Stile-and-Rail Doors: Multi-light doors to be wood muntins and bars with true-divided light and putty or wood glazing beads in profiles as detailed.

D. Exterior Custom Rail-and-Stile Door: AWI premium grade with solid sticking, raised panels and panel mouldings as details. Material: Swietenia Mahogany or approved equal.

E. Custom Doors shall be fabricated to match existing dimensions and profiles in every respect. Stock doors that do not match anticipated details will not be accepted as a substitute or as an equal.

PART 3 - EXECUTION

3.01 EXAMINATION & PREPARATION

A. Verify adequacy of frame opening conditions.
B. Verify frame opening sizes and tolerances are acceptable and ready to receive this work.
C. Condition doors to prevailing temperature and humidity prior to installation.
D. Do not install doors in openings until the risk of damage from other trades has been minimized.

3.02 INSTALLATION

A. Install work in accordance with AWI Custom Quality Standard and manufacturer's written instructions.
B. Set and secure material and components in place, plumb and level.
C. Install doors in accordance with NFPA 80.

D. Trim non-rated door width by cutting equally on both edges.
E. Trim door height by cutting bottom edges to a maximum of 3/4” (19mm). Where more than 3/4" is required (e.g. for exhaust air purposes in toilet rooms), provide factory undercut on doors where 1” undercuts are indicated on the schedule.
F. Pilot drill screw and bolt holes.
G. Machine cut for hardware. Core for handsets and cylinders.
H. Coordinate installation of door, frames, glass, glazing and accessories.
I. Site glaze in accordance with Section 08 80 00 – Glazing.

3.03 REPAIRS AND MODIFICATIONS

A. Repairs to existing wood doors and frames where hardware is removed or repairs are required. Note that existing doors and frames that will be salvaged and reused require removal of existing hardware unless noted otherwise.
   1. Existing door hinges will be replaced unless noted otherwise in the Hardware Schedule in Section 08 71 00. Fill former screw holes in doors and frames and enlarge mortises to the extent required.
   2. Fill any splits in existing frames and doors to restore wood integrity.
   3. Replace damage portions of frames and casings where prior hardware required cut-outs and partial removal of original woodwork. This is especially prevalent at the use of some closers and in all locations where padlocks were installed on closet and storage room doors.
   4. Former locksets were typically mortise cases with knobs and keyholes. Strikes, in some locations, were replaced multiple times.
   5. It is the intent of this project to retain and repair as much of the original wood materials as possible. Replacement with in-kind materials, where repairs are too labor-intensive or where they will be too visible, will be allowed.
   6. Attention is directed to Section 00 31 19 – Existing Conditions regarding the need to ascertain the level of repair work anticipated by careful review of conditions.
B. Repairs to doors and frames may be executed with in-kind replacement wood (dutchmen or replacement portions) or with wood repair products by one of the following manfacturers:
   1. Abatron: www.abatron.com
   2. Advanced Repair Technology: www.advancedrepair.com.
   3. West System: www.westsystem.com.
C. Refer to repair product instructions per manufacturer’s literature. Also refer to wood repair information in Section 08 52 00 – Wood Windows.

3.04 ADJUSTING AND CLEANING

A. Conform to AWI Standards for fit and clearance tolerance.
B. Conform to AWI Standards and Test for warp, cup, bow and telegraphing. Replace any door that exceeds allowable tolerances.
C. Reseal or refinish the edges, including concealed edges (top and bottom) of any doors that require site alteration.
D. Rehang or replace any doors that do not swing or operate freely even after attempting to re-fit and re-install.
E. Clean and protect wood doors from damage until acceptance of the Work.

END OF SECTION

SECTION 08 31 00 – ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Wall access doors.
   2. Ceiling access doors.
   3. Related hardware and attachments.
B. Each mechanical and electrical trade shall be responsible for furnishing the required quantity and sizes of access doors to the General Contractor for installation into the framing systems where needed.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this Section. Other Sections that relate directly to work of this Section include, but are not limited to, the following:
   1. Section 06 10 00 Rough Carpentry.
   2. Section 06 20 23 Interior Finish Carpentry.
   3. Section 09 21 16 Gypsum Board Assemblies.
   4. Section 09 90 00 ***Painting and Coating (Filed Sub-Bid).
   5. Section 22 00 00 ***Plumbing (Filed Sub-Bid).
   6. Section 23 00 00 ***HVAC (Filed Sub-Bid).
   7. Section 26 00 00 ***Electrical (Filed Sub-Bid).

1.04 SUBMITTALS

A. Comply with Section 01 33 00 Submittal Procedures and 01 60 00 Product Requirements.
B. Shop Drawings:
   1. Door and Panel Units: Show types, elevations, thickness of metals, full size profiles of door members.
   2. Hardware: Show materials, finishes, locations of fasteners, types of fasteners, locations and types of operating hardware, and details of installation.
   3. General: Show connections of units and hardware to other Work. Include schedules showing location of each type and size of door and panel units.
C. Product Data: Manufacturer’s technical data for each type of access door and panel assembly, including setting drawings, templates, fire-resistive characteristics, finish requirements, and details of anchorage devices.
   1. Include complete schedule, types, locations, construction details, finishes, latching or locking provisions, and other pertinent data.
D. Manufacturer's Installation Instructions: Indicate installation requirements and rough-in dimensions.

E. Design Requirements & Verification: Obtain specific locations and sizes for required access doors and frames from trades, including mechanical and electrical, requiring access to concealed equipment and indicate on submittal schedule.

1.05 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain access door and panel units, and frames for entire Project from one source and a single manufacturer.
B. Coordination: Provide inserts and anchoring devices that will be built into other Work for installation of access door assemblies. Coordinate delivery with other Work to avoid delay.

1.06 DELIVERY, STORAGE AND HANDLING

A. Package and ship per manufacturer's recommendations.
B. Store per manufacturer's instructions.
   1. Store in dry area out of direct sunlight.

1.07 WARRANTY

A. Warrant materials and workmanship against defects after completion and final acceptance of Work.
   1. Repair defects, or replace with new materials, faulty materials or workmanship developed during the guarantee period at no expense to Owner.
   2. Access Panel Warranty: one year from date of Substantial Completion as determined by the Architect.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products from Nystrom Building Products (9300 73rd Avenue North, Brooklyn Park, MN 55428; 763-488-9200; http://www.nystrom.com); Milcor (815 Kimberly Drive, Carol Stream, IL 60188; 800-624-8642; http://www.milcorinc.com) or approved equal.
B. Specifications and Drawings are based on manufacturer's proprietary literature from Nystrom Building Products. Other manufacturers shall comply with minimum levels of material, color selection, and detailing indicated in Specifications or on Drawings.

2.02 MATERIALS

A. Commercial quality, cold steel sheet with baked on rust inhibitive gray primer.

2.03 ACCESS PANELS

A. Flush access doors, for walls and ceilings in closets and other concealed areas or non-public spaces where approved for use by the Architect.
   1. Nystrom NW or NP; Milcor DW or K.
   2. Hinge: Concealed.
   3. Latching/Locking Devices: Screwdriver cam latch – standard.
   4. Finish: Phosphate dipped with factory applied prime coat.
B. Recessed access panels for finished walls and ceilings for application of finish materials to match adjacent surfaces.
   1. Nystrom RW or RP; Milcor DWR or AP.
   2. Hinge: Concealed.
   3. Latching: Key operated cylinder cam lock with 2 keys per lock, keyed alike.
   4. Finish: Phosphate dipped with factory applied prime coat.

C. Fire-rated versions of access doors styles noted above for fire-rated walls and ceilings where required.

2.04 FABRICATION

A. Manufacture each access panel assembly as an integral unit ready for installation.
B. Welded construction: Furnish with a sufficient quantity of 1/4 inch mounting holes to secure access panels to types of supports indicated.
C. Recessed panel: Form face of panel to provide specified recess for application of finish material. Reinforce panel as required to prevent buckling.
D. Furnish number of latches required to hold door in flush, smooth plane when closed.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that rough openings for door and frame are correctly sized and located.
B. Verify clearance requirements for ceiling or wall access panels.

3.02 PREPARATION

A. Advise installers of work relating to access panel installation including rough opening dimensions, locations of supports, and anchoring methods. Coordinate delivery with other work to avoid delay.

3.03 INSTALLATION

A. Install access door and frame units per manufacturer's written instructions.
B. Install frames plumb and level in opening. Secure rigidly in place.
C. Position units to provide convenient access to concealed Work requiring access.

3.04 ADJUST AND CLEAN

A. Adjust panel after installation for proper operation.
B. Remove and replace panels or frames that are warped, bowed, or damaged.

END OF SECTION

SECTION 08 51 69 – METAL STORM WINDOWS

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to The Awarding Authority's CONTRACT DOCUMENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide aluminum storm windows at all exterior window openings.
   1. Triple-track double hung units at all operable windows.
   2. Fixed units at all inoperable windows.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION.
B. Related work specified in other Sections include but may not be limited to the following:
   1. Section 01 11 00 Summary of Work.
   2. Section 07 92 00 Joint Sealants.
   3. Section 08 52 00 Wood Windows.
   4. Section 09 90 00 ***Painting & Coatings (Filed Sub-Bid).

1.04 SUBMITTALS

A. Product Data: Manufacturer's data sheets for specified products showing compliance with specified requirements; include installation instructions.
B. Shop Drawings: Show dimensions, layout, profiles and product components; details of anchoring and fastening; sealants and weatherstripping; and recorded field measurements.
C. Finish Samples: Submit color samples, for approval by Architect, that represent the allowable range of finish established from production material specified.
   1. "Snow Mist" white will likely be selected, assuming that the restored wood windows will be painted white to match existing.
D. Component Samples: Submit samples of anchors, fasteners, hardware, assembled corner sections and other materials and components.
E. Operation and Maintenance Data: Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
F. Executed warranty documents specified.

1.05 DELIVERY, STORAGE AND HANDLING

A. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
B. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
   1. Store inside, if possible, in a clean, well-drained area free of dust and corrosive fumes.
   2. Stack vertically or on edge so that water cannot accumulate on or within materials. Use non-staining wood or plastic shims between components to provide water drainage and air circulation.
   3. Cover materials with tarpaulins or plastic hung on frames to provide air circulation.
   4. Keep water away from stored assemblies.

1.06 WARRANTY

A. Manufacturer's Warranty: Submit manufacturer's standard 10-year warranty.

1.07 TESTING AND PERFORMANCE REQUIREMENTS

A. Test Specifications: Provide test results in accordance with AAMA 1002.10-93, "Aluminum Insulating Storm Products for Windows and Sliding Glass Doors." Meet or exceed the performance requirements for DP-20 rating.

B. Required Test Results
1. Operating Force: 17 lbs.
2. Air Infiltration – ASTM E 283: 0.04 cfm/ft @ 1.57 psf (25 mph).
3. Water Resistance – ASTM E 331: No leakage with and without screen at WTP = 4.0 psf for three minutes.
4. Uniform Load Structural: No damage @ 30 psf exterior and interior.
5. Safety Drop Test: No damage.
6. Glass and Screen Inserts: Squareness Test 1/16" maximum.
7. Attachment of Insert Screening to Frame Test: 40 lb. minimum.
8. Concentrated Load and Glass Adherence Test, Sash: 15 lb. minimum

PART 2 – PRODUCTS

2.01 MATERIALS

A. Acceptable Product: Provia "Concord" Double-Hung Storm Windows: https://www.provia.com/aluminum-storm-windows

B. Manufacturer's Representative: Harvey Industries: https://www.harveywindows.com/

C. Requests for substitutions will be considered for products that meet or exceed product charateristics.

2.02 STORM WINDOW COMPONENTS

A. Storm Windows - General: Provide units that fit existing windows without gaps of more than 1/8 inch (3 mm) in each unit.
1. Verify actual measurements of openings by field measurement before fabrication; show recorded measurements on shop drawings.
2. Allow for out-of-square and irregular conditions.
3. Verify frame and sill conditions of each opening before fabrication; provide appropriate fabrication details to suit existing conditions.

B. Materials: All aluminum extrusions shall be 6060 and 6063-T5 heat-treated aluminum alloy with a nominal wall thickness of .050". Self-tapping screws used in the assembly of the window shall be stainless steel, finished to match window color.

C. Frame Construction: The frame shall be of butt-type construction anchored with two stainless steel self-tapping screws at each corner. Each screw shall be driven into an extruded boss, which is an integral part of the jambs. The jamb shall form a channel that receives the sash and holds it securely in place between two sections of woolpile weatherstripping. The sill shall incorporate double fin type weatherstripping running the full width of the sill. The sill and bottom sash shall interlock in a tongue and groove manner for additional weather protection when in the closed position. There shall be an adjustable expander on the sill to compensate for out-square opening. The sill expander shall have two weep holes to allow drainage to the outside. The header frame shall provide penetration of the top sash by 3/4" and be sealed with fin type weatherstripping on the inside frame leg and heavy duty woolpile on the outside of sash head. The frame shall have an integral concealed RIGID-BAR at the meeting rail which shall incorporate two full lengths of fin type weatherstripping, one on each side, and two extruded legs into which both sash interlock independently. The RIGID-BAR shall be a hollow aluminum extrusion with two screw bosses permitting it to be fastened in place by four

stainless steel screws driven through the main frame. Installation flange shall be pre-punched. A snap-on finished cover shall be applied to inside stile at the meeting rail.

D. Sash Construction: Glass inserts shall have spring loaded zinc-die cast latches with 5/8" operating space to allow easy operation. Sash corners shall be mitered and joined with zinc die-cast corner keys and secured with stainless steel screws through the vertical rails for easy glass replacement.

E. Screen Construction: Screen frame shall be of hollow extruded design with overlaps at sides of frame. Heavy-duty woolpile shall be inserted in the top of the screen section to provide an effective insect seal when in the summer position. Screen wire shall be 18 x 16 mesh; non-glare charcoal finished aluminum and shall be held in place with corrugated vinyl screen spline.

F. Operation: Each operable window shall be complete with two operating sash and one screen insert. The window shall be of triple channel design, constructed to form back retaining walls for both glass inserts when in the closed position. Each glass insert and screen shall ride in its own channel, guided by top pivot pins and shall be removable from inside without the use of tools. There shall be racheted locking positions for each sash at 1" increments.

   1. Provide fixed units at inoperable windows noted as being fixed in the Window Schedule.

G. Hardware: All spring-loaded latches are to be black finish zinc die-cast. Screen latches are to be of teardrop design to facilitate easy accessing to screen insert.

H. Glazing: Standard glazing shall be marine glazed in vinyl channel with single strength type B domestic float glass: provide with manufacturer's low-E coating.

I. Weatherstripping: All critical areas shall be double weatherstripped with a fin type weatherstripping.

J. Finishes: All window finishes shall be electrostatically applied baked acrylic in manufacturer's standard colors. Architect shall select one standard color.

K. Sealant: Provide per Section 07 92 00.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that openings are within allowable dimensional tolerances, plumb, level, and clean, provide solid anchoring surface, and are in accordance with approved shop drawings.

B. Do not install windows until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions, including product data, technical bulletins, catalog installation instructions, and carton instructions.

B. Install storm windows straight, plumb and level, securely fastened, and without distortion.

C. Adjust as required for proper operation of operable units.

D. Fully seal abutment of frame to wood window components for weathertight installation.

3.03 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 08 52 00 – WOOD WINDOWS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but limited to the following:
   1. At the east wall of Ground Floor following removal of existing exit door, provide replica of missing wood window frame and single-hung unit to match adjacent original units.
   2. Repair deteriorated existing wood windows in all locations.
   3. Install exterior storm windows per section 08 51 69.
   4. Provide window hardware as noted herein.
   5. Glass and shop glazing related to work of this Section.
   6. Preparation and final painting of restored and repaired wood window sash and frames.
   7. Priming of replacement wood window sash and frames (final painting by painting sub).
   8. Other miscellaneous window work as noted or as required.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 01 35 43 Environmental Procedures.
   2. Section 02 41 00 Demolition.
   3. Section 02 82 00 Asbestos Remediation.
   4. Section 06 10 00 Rough Carpentry.
   5. Section 06 10 23 Exterior Finish Carpentry.
   6. Section 06 20 23 Interior Finish Carpentry.
   7. Section 07 92 00 Joint Sealants.
   8. Section 08 14 00 Wood Doors.
   9. Section 08 80 00 Glazing.
   10. Section 09 21 16 Gypsum Board Assemblies.
   11. Section 09 90 00 ***Painting and Coating (Filed Sub-Bid).

1.04 SUBMITTALS

A. General: Refer to SECTION 01 33 00 – SUBMITTAL PROCEDURES for submittal provisions and procedures as applicable for the work of this Section.
B. Shop Drawings: Submit Shop Drawings for proposed replacement components. Show all relevant details, profiles, dimensions, joinery and methods of attachment.
C. Product Data and Material Samples: Submit complete product data sheets, installation instructions and general recommendations for the materials listed. Submit samples of actual materials as applicable:
   1. Wood for replacement window components.
   2. Epoxy repair system for wood repairs.
   3. Glass and Glazing.
   4. Window hardware.
   5. Paint products.

6. Paint removal products.

D. Mock-Up Sample:
   1. Upon review and approval of all submittals noted above, perform complete specified repair and restoration treatment on a typical original window to be selected by the Architect.
   2. Obtain Architect's approval of the mock-up prior to proceeding with repair and restoration work on the remaining windows. No other work described within this section, including mobilization and purchase of materials, shall commence until approval of the completed mock-up.
   3. Staging provided by the General Contractor, where required for the Work, shall remain in place for review of mock-up.
   4. Protect the approved mock-up until the completion of all the work of this Section.
   5. Approved mock-up shall represent the minimum acceptable standard for the project.

1.05 QUALITY ASSURANCE

A. Window Repair & Restoration Specialist: Work shall be performed by a firm having not fewer than five (5) years successful experience in comparable wood window repair and restoration projects and employing personnel skilled in the processes and operations required.
   1. Specialist must have performed work of a similar nature on at least three (3) historic buildings similar to the existing building.
   2. Specialist must utilize skilled workers who have previously demonstrated experience in the work of this Section.
   3. Specialist must be acceptable to, or certified by, the manufacturer of the epoxy system to be utilized for restoration and repair work.

1.06 REFERENCE STANDARDS

A. Woodwork Standards: Newly furnished elements, where needed, shall be manufactured in compliance with the requirements for "Premium" grade workmanship as specified in "Quality Standards of the Architectural Woodwork Industry" as published by the Architectural Woodwork Institute, except where more stringent requirements may be specified in this Section.

B. Glazing Standards: Comply with recommendations of the Flat Glass Marketing Association (FMGA) "Glazing Manual" and "Sealant Manual" except where more stringent requirements may be specified in this Section.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site in manufacturer's original and unopened containers and packaging, bearing labels as to type and names of products and manufacturers.

B. Store materials only in designated areas and in compliance with the manufacturer's requirements for minimum and maximum temperature and other conditions. Keep materials in tightly closed containers and away from open flames.

C. Discard and remove from the job site any materials damaged in handling and storage; any materials that have been subjected to conditions contrary to manufacturer's recommendations, and; any materials whose maximum shelf life has expired.

1.08 PROJECT CONDITIONS

A. Environmental Requirements: Epoxies, glazing, sealants and paint may only be applied to surfaces when air, surface and material temperature and moisture content are within the range approved by the manufacturers. Proceed with work only when existing and forecasted weather conditions permit work to be performed in accordance with the manufacturer's requirements.

B. Prevent Spillage of repair and restoration materials onto adjacent interior and exterior surfaces that may be exposed to damage or staining. Clean up spills and drips immediately and refinish any areas that are affected by the work of this Section.

C. Substrate Conditions must be inspected and determined to be in satisfactory condition prior to the installation of products specified in this Section.
D. Paint & Glazing Compound Removal must be performed with the utmost care and concern for both the integrity and preservation of the historic materials and the safety and health of workers, building occupants and the public.
   1. Note that the existing paint may contain lead. Take all necessary precautions and conform with all applicable local, state and federal regulations.
   2. Select removal methods that fully comply with regulations and that will not damage existing wood and surrounding surfaces. Remove paint to bare wood with a neutral pH chemical stripper. Follow manufacturer's guidelines for application and clean up.
   3. Do not use torches, heat guns or any type of heat-generating equipment that will damage the wood surface, break the glass or create a fire hazard to the existing building or to existing materials temporarily removed from the building for repair and restoration.
   4. Do not use steam cleaning for paint removal due to damage caused by temperature extremes and excessive moisture absorption into the historic wood members.
   5. Do not remove paint by dipping sash or other window components into a chemical bath used for paint removal. Chemical bath treatments are acidic in composition and penetrate the wood, and subsequent neutralization treatment will not counteract all penetrated residue, resulting in poor adhesion of applied paint coatings.
   6. Properly dispose of all residue generated from paint and putty removal in accordance with all applicable regulations.
E. Scheduling & Coordination: Coordinate the repair and restoration work with related work including the provision of temporary protection, staging and masonry work. Comply with the Owner's requirements for maintaining security for the building and its occupants.

1.09 GUARANTEE

A. Provide written guarantee ensuring that all replacement wood elements, patching materials and sealant joints shall remain sound and free of defects, cracks, joint failure, peeling, deterioration, and discoloration for a minimum period of two (2) years from the date of Substantial Completion. Further state that any such defects occurring within the warranty period will be repaired or replaced at no cost to the Owner in a manner conforming with the requirements of this Section.

PART 2 - PRODUCTS

2.01 GENERAL

A. A minimum of three manufacturers is listed below for the primary wood repair and restoration materials. Products of other manufacturers that have proven to be equal or superior in performance to those listed will be considered. For each product type, provide products from one manufacturer. Confirm that the product selected is fully compatible with the project conditions and requirements.

2.02 WOOD REPAIR, REPLACEMENT & REPLICA MATERIALS

A. Wood Repair Products shall be high-performance, non-shrinking, elastic epoxy repair system specifically developed, tested and proven effective for successful use in the preservation and repair of decayed and damaged wood. Acceptable manufacturers and products include:
   1. "Liquid Wood" consolidant/primer and "Wood Epox" structural adhesive compound by Abatron, Inc.; 5501 95th Avenue; Kenosha WI 53144; Tel. (262) 653-2000; www.abatron.com
   2. "Primatrate" flexible cell-bonding primer and "Flex-Tec HV" elastomeric wood repair compound by Advanced Repair Technology; PO Box 510; Cherry Valley NY 13320; Tel. (607) 264-9040; www.advancedrepair.com

3. "West Systems" three-component epoxy repair product with resin, hardener and filler by Gougeon Brothers, 102 Patterson Avenue, Bay City MN 48707, Tel. (989) 684-7286; www.westsystem.com

B. Wood Replacement Products for splicing, dutchmen, replacement and replica window components shall be of an identical wood specie (except as noted) as original windows on the project. The wood shall have the same profile, grade, cut, hardness & grain structure as the existing window components.
   1. It is assumed that the existing wood used for sash and frames is Eastern White Pine. If possible, utilize old growth wood salvaged from a known source that has identical characteristics to the existing wood. If salvaged wood in good condition cannot be found, the use of clear Swietenia Mahogany or Sapele with tightly spaced vertical grain will be preferable to the use of new growth pine.
   2. Parting Beads shall be clear mahogany or Sapele; pine shall not be allowed (unless old growth stock).
   3. Interior stops are assumed to be painted pine; replacement interior stops are to be clear pine or poplar.
   4. All wood shall be kiln-dried to a moisture content of six (6) to twelve (12) percent at the time of fabrication.
   5. Wood shall be free from shakes, large or loose knots and free of all structural imperfections that might impair its strength, durability, performance and compatibility with existing components.
   6. Finger-jointed stock shall not be allowed.

2.03 RELATED MATERIALS

A. Pulleys, Weights & Chains: Existing pulleys and weights, where extant and in serviceable condition, shall be retained. Replacement pulleys shall match existing. Existing cords shall be discarded and replaced with solid bronze US 10B (oil rubbed bronze) sized appropriately for the weight of the sash and the width of the pulley wheel. Provide replacement chains for lower sash only (modify for single hung operation). Chains shall be as manufactured by one of the following companies or an approved equal:
   1. The Architectural Resource Center, 557 Old Turnpike Road, Northwood NH 03261, Tel: 800-370-8808, Fax: 603-942-7465; www.aresource.com.
   2. Bronze Craft Corporation, 37 Will Street, PO Box 788, Nashua NH 03061-0788, Tel: 800-488-7747, Fax: 603-883-0222; www.bronzecraft.com.
   3. Phelps Company, 759 Brattleboro Rd, Hinsdale NH 03451, 603-336-6213, Fax: 603-336-6085; www.phelpscompany.com.

B. Weather-stripping: Existing primary window sash do not have any weather stripping and none will be provided in the restoration due to the provision of storm windows.

C. Other Window Hardware shall be as noted below. Product numbers noted must be confirmed for suitability based on dimensions and adjacent construction.
   1. Double-Hung Windows:
      a. Sash Lifts: None.
      b. Sash Locks: Remove existing sash locks and keepers; lubricate. Replace fasteners with matching screws and reinstall in restored sash. Match existing sash locks at new units or for any damaged or missing locks.
      c. Sash Limiters: none required.
   2. Interior Window Stops: Solid brass screws with slotted recessed finish washers for allowing up to 1/8" of adjustability in setting stops; Phelps SBA62 in US10B.

D. Glass & Glazing shall be provided under the Work of this Section; refer also to project requirements as noted in SECTION 08 80 00 – GLAZING.
   1. Provide glass in replicated windows to match existing.
   2. Remove and reuse glass in existing windows that are scheduled to be restored.
   3. Replace existing glass that is missing, broken or becomes broken during work.
   4. Glaze glass into primed glazing rabbet.

E. Paint Removal stripper products shall be neutral pH as noted in "1.08 Project Conditions" in this Section. Heat-related removal techniques will not be allowed on site.

F. Sealant shall be as noted in SECTION 07 92 00 – JOINT SEALANTS.

PART 3 - EXECUTION

3.01 WOOD WINDOW REPAIR SCOPE

A. General: Refer to the Drawings for the configuration and location of all windows.
B. It is the bidder's responsibility to become familiar with the level of repair and restoration treatment needed at each opening prior to submitting a bid.
C. Inspect Surfaces of both the weather and non-weather sides of windows to be repaired. Inspect all surfaces of the wood to determine method and extent of treatment.
   1. Surface areas where wood decay, deformation and deterioration are present require repair and restoration treatment.
   2. Surface areas that do not match their original profiles but are otherwise structurally sound do not require repair.
   3. Areas of major surface and sub-surface damage & deterioration require splicing, dutchmen infill repairs or complete repairs with in-kind materials.
   4. Inspect wood sills for natural defects (knots), cracks and checks. Check for presence of wood decay or soft rot from weathering and UV exposure. Check for concealed deterioration due to water infiltration.
D. Inspect Joints and Edges of all wood members of frame and sash.
   1. Check all joints between wood members for open seams. With moisture meter, measure the wood moisture content level at random locations directly surrounding the joint. Check for presence of wood decay or soft rot from weathering and UV exposure.
   2. Check edges and ends of wood members for presence of wood decay, splits, water damage or soft rot from weathering and UV exposure.
E. Examine the operation and characteristics of the sash and record its fit to the frame. Determine inherent dimensional irregularities that may need to be retained in order to assure a proper fit in the frame following the restoration work. Record all observations.

3.02 REPLICATED WOOD WINDOW

A. Refer to Drawings for location and details of replicated wood window unit to replace an existing exit door. Match adjacent historic windows in ever respect.

3.03 REMOVAL OF WINDOWS TO BE RESTORED

A. Remove existing sash in accordance with the approved job sequencing schedule. Remove upper and lower sash at all openings. Number each sash in accordance with the window elevation location index. Coordinate removal with provision of temporary protection in openings. Transport sash off-site for restoration, unless appropriate provisions for on-site work are determined to be acceptable to the Owner and General Contractor. Minor cleaning and repairs may be performed on site.
B. Remove and discard all existing redundant non-original hardware, fasteners, mending plates, nails, non-original weather-stripping, caulking cords, window coverings, room-darkening shades (including frames and tracks), plastic sheeting or panels and any other items made obsolete by the work of this Section. Do not discard existing, original sash locks until approval of submitted replacement hardware has been obtained.
C. Remove sash pulleys and retain for cleaning, lubrication and re-use.
D. Remove sash chains and cords and discard.
E. Remove parting beads and discard.
F. Remove paint from window frames to bare wood in area where wood is fissured or deteriorated. Paint removal shall extend at least 2 inches beyond area to be repaired. Remove loose and deteriorated paint to sound earlier coatings in preparation for priming. Sand edges of intact paint layers to feather any sharp layers to adjacent substrate. Remove existing paint from wood-to-wood contact surfaces such as sash tracks. Retain all well-adhered paint in other areas of frame and do not remove except where repairs are needed.
G. Remove paint from window sash to the same extent required for window frames as noted above. Retain all well-adhered paint.
H. Remove glazing putty in its entirety.

I. Remove glass and salvage for reuse in same locations. Remove any non-glass sheets where extant.
J. Remove interior stops at jambs and salvage for reuse except where damage and not suitable for reuse. Do not remove head stops unless deteriorated. Remove added stops at stools where present and discard.
K. Retain existing shutters and shutter hardware in place. Also retain shutter hardware in locations where shutters are no longer present.
L. Remove any other items as noted on the Drawings or made redundant by the Work.

3.04 WOOD REPAIR AND RESTORATION

A. Preservation and Sealing of Seams and Joints: Areas which are open are to be further cut open to a depth of 10 mm (3/8-inch) and width of 4 mm (1/8-inch). Remove soft wood, weathered wood and all decayed wood. Check the moisture content and hardness of the wood structure in and around the joint with moisture meter. Continue with repairs when the moisture content is 18% or less. Sand the bare wood, thoroughly remove all loose fibers, paint, saw dust and dirt to a sound and clean substrate.
   1. Pre-treat bare and sanded wood thoroughly with elastic epoxy primer. Follow selected manufacturer's specific primer instructions.
   2. Apply elastic epoxy repair compound in joint with small modeling knife. Epoxy shall have optimal contact with wood. Avoid inclusion of air pockets in epoxy. Seal joint full, even and smooth in a single application. Allow cure time within the range specified by the manufacturer's instructions.
   3. After curing, sand surface even and smooth. Transitions and irregularities between wood and epoxy shall not be visible after sanding. Remove sanding dust thoroughly.
   4. Smooth any remaining irregularities with fast repair compound applied with modeling knife. Sand lightly and remove sanding dust. Apply specified paint system on sash, stops and frames.
B. Repair of Cracks or Checks in Wood: At each end of crack, drill a hole 3/8-inch in diameter and a minimum of 1/8"-inch deep. Cut crack to a depth of 10 mm (3/8-inch) with router and round cutter (10 mm./ 3/8-inch dia.) Remove all decayed wood. Check moisture content and hardness of the wood structure in and around the crack with moisture meter. Continue with repairs when moisture content is less than 18% displayed. Sand the bare wood, thoroughly remove all loose fibers, paint, saw dust and dirt to a sound and clean substrate.
   1. Follow same procedure as described in 3.04/A.1 through 3.04/A.4 listed above.
C. Repair of Natural Defects (Deteriorated Knots): Sound and tight knots that have not contributed to deterioration of surrounding wood may be retained. Cut out defective knots to a depth of 10 mm (3/8-inch) and width of 4 mm (1/8-inch) with a round cutter (10 mm./ 3/8-inch dia.). Remove soft, weathered wood with router and round cutter (10 mm./ 3/8-inch dia.). Remove decayed wood. Check moisture content and hardness of the wood structure in and around the joint with moisture meter. Continue with repairs when moisture content is less than 18%. Sand the bare wood thoroughly to remove all loose fibers, paint, saw dust and dirt to a sound and clean substrate.
   1. Follow same procedure as described in 3.04/A.1 through 3.04/A.4 listed above.
D. Sealing of Bare Sides and End Grain Wood: All surfaces requiring treatment shall be sanded to bare wood. Remove weathered and decayed wood. Check moisture content and hardness of the wood structure in and around the subject area with a moisture meter. Continue with work when moisture content is less than 18%. Sand the bare wood thoroughly remove all loose fibers, paint, saw dust and dirt to a sound and clean substrate.
   1. Pre-treat bare and sanded wood thoroughly with elastic epoxy primer. Follow selected manufacturer's specific primer instructions.
   2. With brush, apply a layer of medium viscosity elastic epoxy to pre-treated wood. Coating thickness shall be +/- .5 mm (1/32-inch).
   3. After curing, sand lightly and remove sanding dust.
E. Restoration of Missing Sections, Damaged Profiles and Highly Deteriorated Areas: Provide replacement sections, wood dutchmen and epoxy fillers in accordance with system manufacturer's recommendations. Rebuild profiles at areas of structural repair in order to restore member integrity. Replace overly eroded or deformed muntins and bars if

repairs will be too elastic for improving the overall structural integrity of the wood. Replace severely deteriorated window components in their entirety in lieu of repairs where necessary (sill, blind stops, casing band mouldings, sash track, stool, apron, interior stops, etc.).

F. Disassemble Window Sash when replacement of highly deteriorated or damaged components requires that the sash be disassembled in order to perform the necessary repair and restoration work. Reassemble the sash utilizing the traditional draw-bore technique for joining the stiles and rails. Pins shall be square hardwood pegs in round holes. Holes in tenons shall be offset in alignment so that stile and rail are drawn tightly together upon insertion of the pins.

G. Repair Dropped & Bowed Rails by removing member and restoring mortise and tenon joints if joint failure cannot be corrected using other methods. Drill out pins, remove all nails and mending plates. Replace severely bowed lower rails of upper sash if the bow cannot be corrected. Reassemble sash using draw-bore technique described above.

H. Realign Meeting Rails by removing paint build-up at stiles and rails of both sash. Gradually plane existing wood at bottom rail of lower sash if necessary to provide proper clearances. Check alignment of rails frequently in order to remove no more wood than is necessary. Reshape meeting rails if obstructions exist. Allow clearance for paint finishes and weather stripping so that meeting rails align upon completion of the repairs.

I. Restore integrity of weight pocket access covers. Rebuild missing or deteriorated portions of frame track or access panel. Replace panel fasteners.

J. Final Sanding & Preparation shall leave surface even and smooth. Transitions and irregularities between wood and epoxy shall not be visible after sanding. For system utilizing consolidants, final appearance of surface should be similar to veined marble with filler only in the deep recesses and fissures, rather than a continuous coat of filler over the entire surface.

K. Protect Exposed Unfinished Wood Frames from water absorption and adverse affects of weather prior to priming. Provide spot priming on frames at areas of repair. Provide full prime coat on entire exterior frame. Final finish coat painting on exterior frames shall be the responsibility of the Painting Subcontractor. Provide stain at wearing surfaces (wood-to-wood contact) in lieu of paint.

L. Paint Window Sash in the shop with one coat of primer and both finish coats in accordance with the requirements of SECTION 09 90 00 – PAINTING & COATING. Allow sufficient curing time for glazing compound and epoxy systems prior to painting. Touch-up any damaged finishes at the site following installation. Stain stile edges and top of upper sash top rail at wearing surfaces (wood-to-wood contact) in lieu of paint.

M. Re-install Sash in same openings from which they were removed.
   1. Fix upper sash in place. Set in bed of sealant. Provide wood jack from sill to underside of meeting rail full width of track including area of parting bead. Prime all six sides of jack prior to installation.
   2. Provide replacement parting beads at upper portion of window opening from jack to head. Restore parting bead receptors in frames to assure proper fit. Pre-finish parting bead with three coats of tinted boiled linseed oil mixed with dark brown stain prior to installation.
   3. Provide replacement interior wood stops at jambs and stool. Shop paint stops primer plus two finish coats as part of the work of this Section. Nail stops in place and set; fill holes to conceal. Paint stops on site to cover puttied nail holes and to touch-up any damaged finishes.
   4. Install and adjust each sash for proper fit. Lubricate pulleys and provide chains for operation of sash.
   5. Provide replacement sash locks. Fill previous holes and drill new holes of proper diameter to avoid splitting wood.
   6. Refasten any loose portions of exterior casing band moulding. Replace any damaged or deteriorated mouldings. Provide moulding where existing moulding is missing. Install backer rod and sealant at joint between window and siding.

N. Repair and restoration of fixed and casement sash and frames at front façade of Third Floor shall follow same procedures as noted above for double-hung windows, with the obvious exceptions of window configuration, parting beads and the like.

O. Replication of missing hopper sash shall follow same construction techniques of joinery and profiles as was done for the original windows.

3.05 GLASS AND GLAZING INSTALLATION

A. Remove any broken existing glass and its associated glazing compound. Remove and salvage glass for reuse in units to be restored. Remove all non-glass lights. Inspect the wood near the glazing rabbet for any signs of soft rot or decay. Remove all soft rot and decayed wood. Check moisture content and hardness of the wood structure in and around the glazing rabbet joinery with moisture meter. Continue with the work when the moisture content is less than 18%.
   1. Glass and rabbet surfaces must be clean and free of old compound, dirt, moisture, grease, grime and loose wood fibers.
   2. Apply primer to all surfaces of glazing rabbet.
   3. Apply back bead of elastic glazing compound to the rabbet. Press glass firmly into place avoiding inclusion of air pockets. Apply glazier points.
   4. Apply front bead of elastic glazing compound to glass and rabbet.
   5. Apply compound to face of glass, filling rabbet completely.
   6. Smooth compound with applicator knife to an angle that sheds water and finish inside corners slightly rounded.
   7. Remove all excess compound with applicator knife. Remove any cured compound overflow with razor blade; avoid scratching glass. After curing time as recommended by Manufacturer, coat compound and sash with specified primer.

3.06 HARDWARE INSTALLATION

A. Provide hardware and install per manufacturer's instructions. Install lubricated and serviced pulleys. Adjust all hardware for proper alignment and operation.

3.07 SASH OPERATION

A. Install and adjust windows for maximum performance of full range of sash motion. Make any adjustments to tolerances between sash and frame as required for smooth operation and refinish any planed or modified portions.
B. Convert all double-hung windows into single-hung operation so that lower sash only is fully operational. Provide wood jack in upper sash track and seal upper unit in place.

3.08 PROGRESS REVIEW

A. Observation of sash restoration and repair work, whether performed on site or at an off-site location, shall be made available to the Owner and Architect for the purpose of reviewing the progress of the work.

3.09 FINAL CLEANING

A. Clean interior and exterior surfaces promptly after completion of all work. Take care to avoid damage to coatings and finishes. Remove excess sealants, dirt, and other substances. Clean interior and exterior surfaces of glass. Comply with manufacturer's recommendations for final cleaning and maintenance. Remove and replace glass that has been broken, chipped, cracked, abraded or damaged during the construction period.

END OF SECTION

SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not limited to the following:
   1. Provide finish hardware for doors and frames.
   2. Adjust finish hardware at existing doors and frames.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 02 41 00 Demolition.
   2. Section 06 10 00 Rough Carpentry.
   3. Section 06 20 23 Interior Finish Carpentry.
   4. Section 08 11 00 Metal Doors & Frames.
   5. Section 08 14 00 Wood Doors.
   6. Section 08 80 00 Glazing.
   7. Section 09 90 00 Painting & Coating.
   8. Section 26 00 00 Electrical.

1.04 SUBMITTALS

A. Submit for approval cut sheets, product data and hardware schedule proposed for use based on Owner's requirements.
B. Review all hardware sets listed in this Section with field conditions and associated components prior to submission of shop drawings. Submission of shop drawings represents concurrence with all selections listed herein or as revised by further inspection and analysis by the Contractor. The Contractor shall be responsible for assuring that all components submitted are compatible with project conditions, with intended function of specifications, with other hardware and with related components. Submission of shop drawings represents concurrence with all selections listed herein or as revised by further inspection and analysis by the Contractor.
C. Submit templates for layout of all hardware and devices to the supplier of doors and frames immediately upon receipt of approved hardware shop drawings.

1.05 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions and requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. MANUFACTURERS: Single manufacturers of hardware items, where listed in this Section, are listed as a means of describing the standards, functionality, quality and design expectations, not to limit competition from other manufacturers. Equivalent products to those specified will be allowed provided that they meet or exceed the quality of items selected. Acceptable manufacturers include, but are not necessarily limited to: Best, Schlage, Hager, Von Duprin, Stanley, Ives, LCN, Rockwood, Falcon, Pemko, National Guard, Reese, Baldwin and Sargent.

B. HINGES:
   1. EXISTING: Existing hinges to be cleaned and lubricated; replace screws.
   2. 3.5 x 3.5 INTERIOR: Full-mortise, standard weight, low frequency, plain bearing; equivalent to Stanley F179, 3 1/2" x 3 1/2", ball tip finials, except as noted.
   3. 5 x 5 INTERIOR: Full-mortise, heavy weight, high frequency, five knuckle, concealed bearings; equivalent to Stanley CB168, 5” x 5”, ball tip finials.
   4. 5 x 5 EXTERIOR: Full-mortise, heavy weight, high frequency, five knuckle, concealed bearings; equivalent to Stanley CB199, 5 x 5 bronze, ball tips.
   5. OTHER: As noted in the Hardware Schedule.

C. LOCK/LATCH SETS & EXIT DEVICES:
   1. EXISTING: Existing to be cleaned, lubricated and adjusted for smooth operation.
   2. CYLINDRICAL: Schlage ND-Series, Grade 1, Jupiter lever, 2.75” backset.
   3. EXIT DEVICE: Von Duprin or its equivalent. Glass bead conversion kits where required. Cylinder dogging where allowed. Finish US4.
      a. Standard Operation: 99 Series with 07 lever and standard escutcheon.
      b. Exit Only Operation: 99 Series, Dummy Trim, no cylinder.
   4. OTHER: As noted in the Hardware Schedule.

D. LOCK CYLINDERS & KEYING: Provide 6-pin keyway conventional cylinders and two nickel silver keys per lock. Provide facility master keying system; review with Owner prior to provision of cylinders.

E. CLOSERS/OPERATORS: Dark Bronze powder coat finish unless noted otherwise.
   1. EXISTING: Existing closer scheduled to remain.
   2. STANDARD: LCN 1460 Series with standard slim line plastic cover.
   3. HEAVY DUTY: LCN 4040XP Series with standard cover, mounting plate, extra duty arm and components as required by location and configuration.
   4. AUTO OPERATOR: LCN 4630/4640 electro-hydraulic operator with cover, accessories, power supply, power transfer, sequence control and mounting arm to suit. Wall-mounted wired actuators at interior and exterior LCN 8310-856 with 8310-868F flush mount box; wiring configuration shall disable circuit for exterior actuator when door is locked.
   5. OTHER: As noted in the Hardware Schedule.

F. DOOR STOPS:
   1. WALL: Ives No. 407 1/2, wrought brass; adjust type to suit anchorage conditions.
   2. FLOOR: Ives No. 436 or 438, solid brass; type dependent upon field conditions.
   3. OTHER: As noted in the Hardware Schedule.

G. DOOR HOLDS:
   1. WALL: Ives No. 445 or 449, solid brass; type to suit anchorage conditions.
   2. FLOOR: Ives No. 450, solid brass.
   3. MAGNETIC: LCN 7800 Series die-cast magnetic hold open devices.
   4. OTHER: As noted in the Hardware Schedule.

H. PUSH / PULLS:
   1. PUBLIC: Ives 8311 Pull Plate (8111-5 pull with 8300 pull plate); 8200 Push Plate; 4” x 16”; US26 finish on toilet room side / US4 finish public side; brass.
   2. PRIVATE: Ives 8311 Pull, 8300 Push, US26 on interior, US4 on exterior, brass; Ives 336B in strike jamb.

I. SILENCERS: Equivalent to Ives SR64 for metal frames and SR65 for wood frames.

J. WEATHER STRIPPING: As noted in the Hardware Schedule.

K. THRESHOLDS: As noted in the Hardware Schedule.

L. MISCELLANEOUS: Hardware noted in the Schedule without specification shall be selected by the supplier based on recommended type and quality for the application.
M. FINISH: US4, satin brass, except as noted otherwise.

2.02 HARDWARE SETS

A. SET H.A: Lower Lobby Entry / Door 0.01

Exit Device:	Standard Operation
Hinges:	5 x 5 Exterior, 1.5 Pair
Closer:	Heavy Duty
Door Hold:	Wall
Threshold:	Pemko
Weather-Stripping:	Pemko
Keying:	Standard

B. SET H.B: Lower Stair / Door 0.02

Exit Device:	Standard, Passage
Hinges:	5 x 5 Interior, 1.5 Pair
Door Hold:	Magnetic
Threshold:	Wood
Silencers:	Standard

C. SET H.C: Men & HCAP Restrooms / Doors 0.03, 0.04

Lockset:	Cylindrical, Privacy Function
Hinges:	5 x 5 Interior, 1.5 Pair
Closer:	Standard
Door Hold:	Floor
Threshold:	Marble
Silencers:	Standard
Keying:	Privacy

D. SET H.D: Women / Door 0.05

Exit Device:	Push / Pull
Hinges:	5 x 5 Interior, 1.5 Pair
Closer:	Standard
Door Hold:	Floor
Threshold:	Marble
Silencers:	Standard

E. SET H.E: Meetings / Doors 0.06, 1.08

Lockset:	Cylindrical, Passage Function
Hinges:	5 x 5 Interior, 3.0 Pair
Door Stop:	Wall
Silencers:	Standard

F. SET H.F: Historical Commission / Door 0.07

Lockset:	Cylindrical, Entrance Function
Hinges:	5 x 5 Interior, 1.5 Pair
Door Stop:	Wall
Threshold:	Flush Wood
Silencers:	Standard

G.	**SET H.G:**	**Storage Areas / Doors 0.08, 0.09, 0.12, 1.07**
	Lockset:	Cylindrical, Entrance Function
	Hinges:	5 x 5 Interior, 1.5 Pair
	Closer:	Standard
	Door Stop:	Wall, 0.08 and 1.07
	Threshold:	Flush Wood
	Silencers:	Standard
	Keying:	Standard
H.	**SET H.H:**	**Utilities Interior / Door 0.10**
	Lockset:	Cylindrical, Storage Function
	Hinges:	5 x 5 Interior, 1.5 Pair
	Closer:	Standard
	Threshold:	Pemko
	Silencers:	Standard
I.	**SET H.I:**	**Utilities Exterior / Door 0.11**
	Lockset:	Cylindrical, Storage Function
	Hinges:	5 x 5 Exterior, 1.5 Pair, Plain Tips
	Closer:	Heavy Duty
	Door Hold:	Wall
	Threshold:	Pemko
	Weather-Stripping:	Pemko
J.	**SET H.J:**	**Ell Entry / Door 1.01**
	Exit Device:	Standard Operation
	Hinges:	5 x 5 Exterior, 1.5 pair
	Closer:	Auto Operator
	Threshold:	Pemko
	Weather-stripping:	Pemko
	Keying:	Standard
K.	**SET H.K:**	**Attic Stair / Door 1.02**
	Lockset:	Cylindrical, Entrance Function
	Hinges:	5 x 5 Interior, 1.5 pair
	Closer:	Standard
	Door Hold:	Magnetic
	Silencers:	Standard
	Keying:	Standard
L.	**SET H.L:**	**Pantry / Door 1.03**
	Lockset:	Cylindrical, Entrance Function
	Hinges:	5 x 5 Interior, 1.5 pair
	Closer:	Heavy Duty
	Door Hold:	Wall
	Threshold:	Flush Wood
	Silencers:	Standard
M.	**SET H.M:**	**Great Hall @ Ell / Door 1.04**
	Exit Device:	Standard Operation
	Hinges:	5 x 5 Interior, 1.5 pair
	Closer:	Heavy Duty
	Door Hold:	Floor
	Threshold:	Flush Wood
	Weather-Stripping:	Pemko
	Keying:	None

N.	**SET H.N:**	**Balcony Stair / Door 1.05**
	Lockset:	Cylindrical, Entrance Function
	Hinges:	Existing
	Closer:	Standard
	Door Hold:	Wall
	Threshold:	Existing
	Silencers:	Standard
	Other:	Patch existing door and frame
O.	**SET H.O:**	**Great Hall @ 1848 Entry / Door 1.06**
	Push/Pull:	Existing
	Hinges:	Existing
	Door Hold:	Floor, Pair @ Entry Side
	Threshold:	Existing Modified Per Detail
	Silencers:	None
	Keying:	None
	Other:	Patch existing doors & frames
P.	**SET H.P:**	**Main Entry / Door 1.09**
	Exit Device:	Standard Operation
	Hinges:	Existing
	Closer:	Heavy Duty
	Threshold:	Existing
	Weather-Stripping:	Pemko
	Other:	Patch existing door & frame
Q.	**SET H.Q:**	**Elevator Machine / Door 2.01**
	Lockset:	Cylindrical, Storage Function
	Hinges:	Standard
	Closer:	3.5 x 3.5 Interior, 1.5 pair, Plain Tips
	Door Hold:	Magnetic
	Threshold:	Pemko
	Silencers:	Standard
	Keying:	Standard
R.	**SET H.R:**	**Attic @ Balcony / Door 2.02**
	Lockset:	Existing
	Hinges:	Existing
	Weather-Stripping:	Jambs/Head – Pemko
		Door Bottom – Pemko
	Keying:	Standard
S.	**SET H.S:**	**Attic @ Ell / Door 2.03**
	Lockset:	Cylindrical, Passage Function, Plain Tips
	Hinges:	3.5 x 3.5 Interior, 1.5 pair
	Closer:	Standard
	Door Stop:	Floor
	Threshold:	Pemko
	Weather-Stripping:	Jambs/Head – Pemko
		Door Bottom – Pemko

PART 3 - EXECUTION

3.01 INSTALLATION

A. Follow guidelines of DHI "Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames" and hardware manufacturers' instructions.
B. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other Sections.
C. Salvage existing hardware where indicated to remain in place. Clean, lubricate, remove paint and adjust operation. Provide replacement fasteners to match.
D. At existing doors and frames to be reused, remove redundant and abandoned hardware. Patch holes and voids with appropriate fillers or matching dutchmen as needed. Sand or grind smooth to align patched areas flush with adjacent materials.
   1. In the majority of locations at existing doors and frames, the original hinges were undersized as compared to current standards. In lieu of matching existing hinge mortise cutouts and being below current standards for hinge sizes, patch former screw holes and expand mortise cutouts as needed for specified hinge sizes.
E. Pre-fit hardware to doors and frames prior to the installation of finishes. Remove hardware for installation of finishes by others. Reinstall hardware upon completion of finishes, taking special precautions to avoid the damage of finished items. Adjust operation, clean and protect all hardware components until Substantial Completion.

END OF SECTION

SECTION 08 80 00 – GLAZING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Glass and glazing in doors, sidelights, transoms and borrowed lights.
   2. Glass for mirrors in toilet rooms.
   3. Any other glass or glazing as noted on the Drawings or required by the Work.
B. The following glass and glazing Work will be performed under Section 08 52 00 – Wood Windows:
   1. Replacement of any broken glass in existing windows.
   2. Provision of glass and glazing at replicated historic window at ground floor.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 02 41 00 Demolition.
   2. Section 06 20 23 Interior Finish Carpentry.
   3. Section 08 52 00 Wood Windows.
   4. Section 08 11 00 Metal Doors and Frames.
   5. Section 08 14 00 Wood Doors.
   6. Section 09 21 16 Gypsum Board Assemblies.
   7. Section 09 90 00 ***Painting & Coating (Filed Sub-Bid).
   8. Section 10 28 13 Toilet Accessories.

1.04 SUBMITTALS

A. Submit for approval product data.
B. Submit certification that glass conforms to the required safety standards for their particular locations on the project, including but not limited to, fire resistance ratings and hazardous locations as applicable.

1.05 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Demonstrate that the products proposed are in conformance with applicable provisions of the International Building Code.
B. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Glass for Interior Doors: 1/4'' thick clear safety glass; laminated or clear tempered safety glass for non-rated openings; fire-rated safety glass for rated openings.
B. Glazing for Exterior Doors:
   1. 1/2" thick clear safety insulated glass.
   2. Multi-light true-divided with putty or wood glazing stops in wood muntins.
C. Door, Sidelight, Transom Glazing Materials: Preformed glazing tape with shims, blocks and spacers where appropriate.
D. Mirrors: 1/4" polished float glass mirror in sizes indicated on the Drawings.
E. Glass and Glazing for Exterior Window Repairs: match existing or adjacent with new or salvaged glass with similar visual characteristics.
F. Glass and Glazing for Replicated Historic Windows: salvaged glass to match original extant units or "Light Restoration Glass" by Bendheim or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Examine substrates, supports and conditions prior to installation. Report any unsatisfactory conditions that may result in damage to the Work of this Section to the General Contractor. Do not proceed with Work until conditions are satisfactory.
B. Comply with FGMA "Glazing Manual" and manufacturers instructions and recommendations. Use manufacturer's recommended spacers, blocks, primers, sealers, gaskets and accessories.
C. Install glass with uniformity of pattern, draw, bow and roller marks. Replace any glass with cracks, edge damage or other imperfections.
D. Install glazing tape in continuous bed around entire perimeter of glazing rabbet. Prevent glass from coming into direct contact with surrounding frame or door materials. Install glazing stops. Remove any excess visible sealant from perimeter of frame and stop.
E. Provide mirror support with base J-moulding in satin stainless steel. Provide upper support with satin stainless steel clips in sizes and spacing needed for adequate support of unframed bathroom mirrors. Utilize glazing tape and adhesive to supplement and stabilize installation. Seal edges and seams as detailed.
F. Clean all surfaces of glass upon installation.
G. Repair any damaged glass.
H. Remove temporary protection and provide final cleaning of glass within one week after Substantial Completion.
I. Remove spillage from adjoining work and protect all work from damage.
J. Correct and refinish any work not found to be deficient until after paint has been applied and irregular surfaces become evident.

END OF SECTION

SECTION 08 90 00 – LOUVERS & VENTS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Provide aluminum storm-proof louvers for energy recovery ventilating units.
B. Interior door louvers for the Women's restroom shall be provided under the Metal Doors and Frames Section 08 11 00.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 06 10 00 Rough Carpentry.
   2. Section 06 20 13 Exterior Finish Carpentry.
   3. Section 07 27 00 Air Barriers.
   4. Section 07 46 23 Wood Siding.
   5. Section 07 60 00 Flashing & Sheet Metal.
   6. Section 07 92 00 Joint Sealants.
   7. Section 09 21 16 Gypsum Board Assemblies.
   8. Section 09 90 00 ***Painting and Coating (Filed Sub-Bid).
   9. Section 23 00 00 ***HVAC (Filed Sub-Bid).

1.04 SUBMITTALS

A. Submit to Architect for approval complete product data, details and specifications for all work per the requirements of Section 01 33 00 – Submittal Procedures.
B. Aluminum Louver: Provide complete product description, specifications, catalogue cuts, detailed drawings, selected options, color chart, free area, water penetration data, maintenance and care instructions and any other relevant information.
   1. Color chart shall consist of RAL brochure of actual paint chip samples; photo copied color charts or links to website charts shall not be acceptable.
C. Wood Louvers: Provide shop drawings indicating profiles, joinery, wood materials, screen materials dimensions and relationship to all adjacent construction.

1.05 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers that have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 LOUVER MATERIALS

A. Aluminum Louver:
   1. ERV Vents: Louvers as noted in HVAC specs with bird/insect screen and sill pan; set louver within framed opening and integrate with interior and exterior materials for a weather-tight seal.
   2. Extruded aluminum alloy 6063-T5 louver. Other manufacturer's units with matching characteristics shall be accepted if equal or better.
   3. Finish shall be factory primed and finished after complete assembly with a 3-coat fluoropolymer Kynar 500 resin coating in RAL color to be selected by Architect.
B. Provide louvers complete with fasteners and clips for secure attachment.

PART 3 – EXECUTION

3.01 INSTALLATION OF ALUMINUM LOUVERS

A. Comply with AMCA Standard 500 and provide units with AMCA Certification rating seal. Comply with SMACNA Architectural Sheet Metal Manual except as otherwise indicated.
B. Take field measurements prior to fabrication. Install units plumb and level. Isolate dissimilar materials to prevent corrosion. Touch-up damaged coatings.
C. Install copper sill pans and copper head flashings.
D. Provide bird and insect screens securely attached to blind side of louvers.
E. Clean and protect work from damage throughout the construction period. Restore any damaged finishes and replace any damaged components.
F. Maintain equal blade-to-blade and blade-to-frame spacing for uniform appearance.
G. Provide anchors, supports and accessories as needed. Provide gaskets, flashings and fillers as necessary to make installation water-tight.

END OF SECTION

SECTION 09 21 16 – GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Gypsum wallboard at walls, ceilings, shafts, soffits and portions thereof.
   2. Metal framing support systems and furring for walls, ceilings, shafts and soffits, including suspended supports where finished ceiings are below structural framing.
   3. Wood stud framing support systems and strapping at ceilings where shown or required shall be provided under Section 06 10 00 – Rough Carpentry.
   4. Fire-taped gypsum wallboard on concealed wall surfaces where surface treatment will not be exposed (one coat tape all seams and screw holes, sanded smooth).
   5. Acoustical and fire-resistant sealants where integral to drywall framing systems.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 01 73 29 Cutting & Patching.
   2. Section 06 10 00 Rough Carpentry.
   3. Section 06 20 23 Interior Finish Carpentry.
   4. Section 07 21 16 Blanket Insulation.
   5. Section 07 21 19 Foam Insulation.
   6. Section 07 84 13 Penetration Firestopping.
   7. Section 07 92 00 Joint Sealants.
   8. Section 09 90 00 ***Painting & Coating (Filed Sub-Bid).
   9. Section 14 26 00 ***Limited Use / Limited Application Elevators (Filed Sub-Bid).
   10. Section 22 00 00 ***Plumbing (Filed Sub-Bid).
   11. Section 23 00 00 ***HVAC (Filed Sub-Bid).
   12. Section 26 00 00 ***Electrical (Filed Sub-Bid).

1.04 SUBMITTALS

A. Submit for approval product data for each application.

1.05 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Tolerances: Not more than 1/16" difference in true plane at joints between adjacent boards before finishing. After finishing, joints shall be not be visible. Not more than 1/8" in 10'-0” deviation from true plane, plumb, level and proper relation to adjacent surfaces in finished work.

C. Fire resistance: Provide fire-rated assemblies where required with ratings as determined by ASTM E 119.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Gypsum Board Walls: ASTM C36 in thickness indicated; regular, moisture-resistant and fire-resistant types as required by location; U.S. Gypsum or approved equal. Shaft wall products where indicated or required by location.
B. Gypsum Board Ceilings and Soffits: ASTM C 36 in thickness indicated; regular, moisture-resistant and fire-resistant types as required by location; U.S. Gypsum or approved equal.
C. Steel Studs and Furring Channels: Screw-type steel studs in depths indicated on the drawings or as required for the location. Minimum material thickness shall be 20-gauge ASTM C 645 unless heavier gauge is indicated or required for span or load to meet a maximum deflection of L/360 for each location. Studs shall be hot-dipped galvanized. Channels shall be resilient channels with single leg attachment to studs (RC-1), and if required by the drywall load, double leg attachments to ceiling joists (RC-2).
D. Ceiling Suspension Framing: Metal grid suitably sized, braced and spaced for horizontal and sloping installations based on project locations and configurations; Rockfon “Chicago Metallic Drywall Grid” or approved equal.
E. Fasteners: ASTM C 514 and ASTM C 646. Provide Type S bugle head screws at interior, cadmium plated at humid areas. Provide additional anchors and fasteners as required.
F. Joint Reinforcement & Finishing: Use type of reinforcing tape and joint compound as recommended by manufacturer for specific environments, products and application.
G. Accessories: Galvanized steel corner beads, casing beads, stop beads and control joints in locations required; U. S. Gypsum or equal.
   1. Provide “Tear Away L-Bead” where the ceiling or wall surface directly abuts adjacent wood trim or other dissimilar materials: Trim-Tex PVC Class A rating per ASTM 84 or approved equal.
H. Acoustical & fire sealants and compounds: Concealed acoustical and fire-resistant sealants and fire code compound; U. S. Gypsum or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION – GYPSUM WALLBOARD & METAL FRAMING

A. Comply with ASTM C 840 and GA 216 - Recommended Specifications for the Application and Finishing of Gypsum Board. Provide fire-rated systems where indicated and where required by authorities having jurisdiction.
B. Install resilient channels and stud framing systems in accordance with industry standards and manufacturer's recommendations. Securely fasten and brace studs, suspension grids and furring channels for installation of ceilings, soffits and walls to limit deflection.
C. Provide gypsum wallboard and shaft wall products wherever indicated on the Drawings. Follow manufacturer’s printed guidelines for installation and finishing.
D. Install all boards with 1/4”–3/8” gap between edge of drywall and adjacent construction. Seal joints with acoustical or fire-retardant sealant as required for the partition systems.
E. Install boards vertically or horizontally so that tapered edges abut one another at the joints. Do not allow non-tapered butt-to-butt joints and joints that do not fall over framing members.
F. Provide acoustical and fire-resistant sealant at mounting faces of top and bottom runner tracks and vertical studs at wall perimeters.

1. Respective trades shall install fire stopping and sealants at piping & conduit penetrations, duct openings, expansion and control joints and the like.

G. At ceilings and walls where gypsum wallboard is indicated, install tape and 3-coat joint treatment in compliance with manufacturer's instructions and recommendations. Joint treatment is required at all fasteners and edges between boards. Fill all surface defects. Sand between and after joint treatment coatings. Eliminate any chatter marks, uneven areas, bowed or otherwise distorted finishes that cause uneven light reflectance. Leave ready for application of coatings.

H. In any concealed locations where drywall is indicated, provide finish only to extent necessary for maintaining a continuous, uninterrupted surface for the required fire rating, acoustical separation and/or for a smooth substrate for subsequently applied materials.

I. Do not proceed with work if the environmental conditions are not within the limits prescribed by the manufacturer. Work in areas that are well lit in order to provide careful observation of acceptable tolerances so that a quality finished appearance is achieved.

J. Cut neatly at all corners, edges and around all piping, conduit, devices, ductwork and other penetrations. Fill voids and finish smooth with adjacent surfaces. Re-finish any high or uneven spots that do not allow device plates to fit flush to surface of wall at plate perimeter.

K. Remove spillage from adjoining work and protect all work from damage. Correct and refinish any work that is not found to be deficient until after paint has been applied, devices have been installed and irregular surfaces or voids become evident.

END OF SECTION

SECTION 09 30 00 - TILING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to Division 00 and Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 FILED SUB-BID

A. TILING is stipulated as a filed sub-bid under Part D, Item 2 of the General Bid Form in Section 00 41 13.
B. All sub-bids shall be submitted on the "Form of Sub-Bid" furnished by the Awarding Authority and contained in Section 00 41 13. Sub-bids shall be submitted in accordance with the provisions of Massachusetts General Laws, Chapter 149, Sections 44A-J inclusive.
C. Sub-bids must be filed with the Awarding Authority in a sealed envelope before the local time and the date stipulated in the "Advertisement for Bids" in Section 00 11 13.
D. Specified information relating to sub-bidders is set forth in the Contract Documents under the heading "Instructions to Bidders", in Section 00 21 13 and attention is directed thereto.
E. The Work of this Section is shown on the following Drawings:
   1. Inclusive of all Drawings listed on Drawing A-00 "Project Information" and in Section 00 01 15 "List of Drawing Sheets" and in Division 00 of the Project Manual.

1.03 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not limited to the following:
   1. Ceramic tile floors.
   2. Honed slate thresholds.
   3. Grouting, cleaning and sealing grout.

1.04 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this Section. Other Sections that relate directly to work of this Section include, but are not limited to the following:
   1. Section 03 30 00 Cast-in-Place Concrete.
   2. Section 06 10 00 Rough Carpentry.
   3. Section 06 20 23 Interior Finish Carpentry.
   4. Section 09 21 16 Gypsum Board Assemblies.
   5. Section 09 28 13 Cementitious Backing Boards.
   6. Section 09 64 00 Wood Flooring.
   7. Section 09 90 00 ***Painting & Coating (Filed Sub-Bid).
   8. Section 10 21 13 Toilet Compartments.
   9. Section 10 28 00 Toilet Accessories.
   10. Section 22 00 00 ***Plumbing (Filed Sub-Bid)..
   11. Section 23 00 00 ***HVAC (Filed Sub-Bid)..
   12. Section 26 00 00 ***Electrical (Filed Sub-Bid)..

1.05 REFERENCES

A. Tile Council of North America (TCNA) *2009 Handbook for Ceramic Tile Installation*.
B. ANSI or ASTM specifications as stated by TCNA for the materials to be used in each application.

1.06 PROJECT COORDINATION MEETING

A. Review the Work of this Section on site with the Architect and General Contractor prior to commencement of tiling. Review all transitions, details, clearances at toilet compartments, trimming of mirrors, and any other items related to the design layout.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Ceramic Tile: Daltile, American Olean, or approved equal.
B. Bond Coat: Bostik / Hydroment, Boston St., Middleton, MA 01949; 800-726-7845; www.bostik-us.com; or approved equal recommended by tile manufacturer.
C. Grout Materials: Laticrete International, Inc., 299 Industry Drive , Hamlet NC 28345-7324, 910-582-2252 , fax**:** 910-582-8417 or Bostik / Hydroment, Boston St., Middleton, MA 01949; 800-726-7845; www.bostik-us.com; or approved equal as recommended by tile manufacturer.
D. Mortar Bed: Refer to "Setting Materials" below.
E. Sealers and Coatings: Miracle Sealants Co., 12318 Lower Azusa Road, Arcadia, California 91006; 800-350-1901; www.miraclesealants.com.

2.02 PRODUCTS

A. Ceramic Floor Tile: 2" x 2" hexagonal floor tile mosaic.
   1. 2" x 2" pattern in toilet rooms; DK16.
   2. Price Group 2 (White) + 3 (Black Accents).
   3. 1/4" thickness.
   4. D.C.O.F. > 0.42
   5. Water absorbtion < 0.5% per ASTM C373.
   6. Breaking strength > 200 lbs. per ASTM C648.
   7. Scratch hardness 7.0 – 8.0 per ASTM MOHS.
   8. Chemical resistance per ASTM C650, "resistant."
   9. Manufacturers shall include but not be limited to:
      a. Daltile: "Keystones" floor tile mosaic in pattern noted, or approved equal.
B. Dark gray slate thresholds, honed textures, profile per accessibility regulations.
C. Extra materials: Provide Owner with at least two percent (2%) additional stock of floor tiles from same color lot in unopened, labeled containers for future use and repairs. Also provide unused stock from open containers in marked boxes.
D. Setting Materials:
   1. Adhesive for Slab Substrate: Slurry mix of Portland Cemment sprinkled onto wet floor and swept in; or commercial thinset adhesive if preferred.
   2. Dry Pack Mortar Base: 3 parts sand + 1 part Portland Cement + water to suit for proper adjesion and consistency.
   3. The Thin-set Material: Hydroment Single-Flex F.S. #716 (white) with 425 multi-purpose acrylic latex admixture; or approved equal.
E. Grout: Laticrete PermaColor Grout or Hydroment TruColor Premixed Grout; sanded for floors; or approved equal.
F. Grout Sealer: as recommended by selected grout manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect condition and integrity of all substrate materials prior to commencement of work. Report any discrepancies to the Architect, in writing.
B. Verify that concrete slab substrate has been adequately reinforced and properly installed in order to comply with minimum published requirements of the Tile Council of North America for the installation specified.
   1. Surface must be structurally sound, clean, dry and free of contaminants that may interfere with proper bond.
   2. Slab to have steel towel and fine broom finish with no curing compounds used. Mechanically scarify if needed
C. Review approved layout with Architect in the field if there are any variations between as-built dimension and approved submittals to agree upon any adjustments.
D. Review attachment details for toilet compartments to confirm that adequate blocking in wall support has been installed so that tile floors will not be damaged due to unnecessary torque stress upon completion.
E. Review rough plumbing work and supports. Verify that finished surface of tile will be flush with floor-mounted fixtures.

3.02 INSTALLATION

A. Surface preparation:
   1. Verify that concrete slab is level and true.
   2. Pack gaps around pipes or other penetrations with compressible backing rod and a suitable flexible urethane or silicone sealant.
   3. Surfaces must be structurally sound, clean, dry, and free of contaminants that may interfere with proper bond.
B. Temperature: Substrate and ambient temperature must be between 40°F and 95°F. Allow for extended periods of cure time when temperature is below 60° and/or when relative humidity is greater than 70%.
C. Tile Council of North America (TCNA) *2009 Handbook for Ceramic Tile Installation*:
   1. For ceramic tile mosaic flooring: TCNA method F112-09.
D. Setting Bed: Installation shall follow manufacturer's most recently published installation guideline for preparation; sequence, curing times and placement.
E. Adhesive: Follow manufacturer's instructions for mixing and application.

3.03 GROUTING

A. Follow manufacturer's instructions for mixing, application, and cleaning.

3.04 CLEANING & SEALING

A. Follow manufacturer's instructions for recommended products and procedures.

3.05 EXTRA MATERIALS

A. Deliver extra stock as specified and leave in Owner's care upon completion.

END OF SECTION

SECTION 09 51 13 – ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Acoustical ceiling panels suspended in grid system.
   2. Stock factory transition piece at horizontal to vertical acoustical ceiling to drywall at window heads; material and finish to match manufacturer's grid.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 09 21 16 Gypsum Board Assemblies.
   2. Section 23 00 00 ***HVAC (Filed Sub-Bid).
   3. Section 26 00 00 ***Electrical (Filed Sub-Bid).

1.04 SUBMITTALS

A. Submit for approval product data, samples and installation instructions for each product type per Section 01 33 00 – Submittal Procedures.
B. Provide manufacturer's Health Product Declarations (HPD's) and Environmental Product Declarations (EPD's) for the specified materials.

1.05 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 MATERIALS

A. ACT / Ceiling Panels: Armstrong Products or approved equal:
   1. "ULTIMA Health Zone" square lay-in 24" x 24" x 3/4", NRC 0.70, CAC 38, wet-formed mineral fiber, class A, Item No. 1935; 76% recycled content; EPD.
B. Other Materials: Armstrong products or equal.
   1. Suspended Grid: Exposed grid suspension system intermediate-duty painted steel, typical white color, Class A, 15/16" wide.

2. Window Transition: Armstrong “F Vertical Transition Molding” grid suspension system to vertical drywall; intermediate duty painted steel, typical white color, profile per item No. 7906.
3. Extra Materials: Provide the equivalent of ten percent (10%) of the overall installation of additional whole ceiling panels for each type to the Owner in clearly marked packages.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Inspect ceiling and wall surfaces to insure their suitability for installation of ceiling and grid system. Report any deficiencies in writing to the General Contractor. Contact manufacturer to insure appropriate attachment of product to substrate for each application.
B. Layout grid and ceiling panels in accordance with starting points indicated on the Drawings. Install perpendicular and parallel to building lines except as noted otherwise. Abut joints tightly between panels. Make cuts at ends neatly, square and angled to align with abutting construction.
C. If field conditions differ substantially from the Drawings and require design revisions, review layout of the ceiling grid with the Architect prior to modification and installation.
D. Level grid systems to within 1/8” in 10’-0” in both directions. Align adjacent edges of grid system components. Shim substrate of surface-mounted grid as necessary. Coordinate installation with location of sprinklers, HVAC, electrical, audiovisual and security systems work. Scribe and cut panels to fit accurately.
E. Provide additional ceiling panel materials as noted in Part 2 in wrapped and labeled containers. Clean grid systems, ceiling panels and wall panels upon completion. Replace any damaged components.

END OF SECTION

SECTION 09 54 43 – STRETCHED FABRIC CEILING PANELS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. All components related to the stretched fabric ceiling system.
   2. Coordination with ceiling mounted lighting, fire alarm devices, HVAC penetrations, AV systems and other equipment as required.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 02 41 00 Demolition.
   2. Section 06 10 00 Rough Carpentry.
   3. Section 06 20 23 Interior Finish Carpentry.
   4. Section 07 21 16 Blanket Insulation.
   5. Section 09 21 16 Gypsum Board Assemblies.
   6. Section 09 90 00 ***Painting & Coating (Filed Sub-Bid).
   7. Section 23 00 00 ***HVAC (Filed Sub-Bid).
   8. Section 26 00 00 ***Electrical (Filed Sub-Bid).
   9. Section 27 41 00 Audiovisual Systems.

1.04 SUBMITTALS

A. Submit for approval product data, samples and installation instructions for each product type.
B. Submit layout drawings, edge detail and mounting information for each product type.
C. Submit fire testing certification for each product.

1.05 REFERENCES

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
C. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

1.06 PERFORMANCE REQUIREMENTS

A. Acoustic Attenuation: NRC 0.90, to ASTM C423.
B. Fire Retardant Classification: Class A, to ASTM E84.

C. Fabric: High content stable yarns, acoustically transparent when covering an acoustic substrate.

1.07 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Fabric Ceiling: The fabric ceiling system shall consist of three fire-retardant components:
   1. Framework: Concealed rigid PVC "SNAP-TEX" system as manufactured by SNAP-TEX INTERNATIONAL (111 Park Drive, Montgomeryville, PA 18936, 800-762-7875) in profiles as detailed; or approved equal as noted below.
   2. Acoustical Board: Concealed rigid fiberglass mat "Whispertone Wallboard" by Johns Manville Company (717 17th Street, Denver CO 80202, 800-654-3103) or approved equal.
      a. White formaldehyde-free board in thickness as detailed.
      b. Density of 6.0 pcf; NRC of 0.90.
      c. Recycled Content 56%.
      d. EPD – Environmental Product Declaration.
   3. Fabric: Exposed acoustically transparent widespan fabric "CLIPSO" 495D as represented by Hamilton Associates (781-648-7300); or approved equal.
      a. FR polyester, opaque, p to 200" wide (510 cm).
      b. Color to be selected from manufacturer’s standard palette range.
      c. Warp knit with 10-12% stretch and soil-release finish.
      d. Free of carcinogenic substances (CMR);
      e. Free of volatile organic compounds (VOC).
      f. Fire rated Class A per ASTM E-84.
B. Acceptable Substitutes may include:
   1. "Eurospan" by Wall Technology Inc., an Owens Corning Company; www.eurospanstretchsystems.com; 1-800-932-2383.
   2. "Novawall" by Novawall Systems, Inc.; www.novawall.com; 1-800-695-6682.
   3. "Fabritrak" acoustical ceiling panel system by Fabritrak System, Inc.; www.fabritrak.com; 1-877-322-7482.
   4. Subject to conformance with acoustical properties and quality of appearance as specified herein and as detailed in the Drawings.

PART 3 - EXECUTION

3.01 PREPARATION

A. Inspect substrate surfaces to insure their suitability for installation of stretched fabric ceilings in accordance with manufacturer's requirements. Report any deficiencies in writing to the General Contractor. Contact manufacturer to insure use of appropriate attachment method for product to its specific substrate for each application.
B. Confirm that areas of drywall provided under “Section 09 21 16 – Gypsum Board Assemblies” are level, flush and fire-taped throughout.
C. Ensure substrate surface is smooth, flat, and taped and sealed prior to track installation. Directly adjoining work must be complete and dry.

D. Layout concealed and finished wood blocking as detailed for overall thickness and for secure attachment to ceiling substrate as indicated on the Drawings.
E. Review placement of all required blocking substrates for subsequent attachment of electrical, security, audiovisual, eyebolts, sprinkler and any other devices that need to be attached through fabric surface to insure a successful installation and finish.
F. Do not proceed until surrounding environment is clean and dry.
G. Maintain temperature, and humidity at conditions approximating those of occupancy prior to, during, and after installation.
H. Level systems to within 1/8” in 10’-0” in both directions. Align adjacent edges of system components. Shim substrate of surface-mounted products as necessary. Coordinate installation with location of mechanical and electrical work. Scribe and cut components to fit accurately.

3.02 INSTALLATION - FABRIC CEILING

A. Field measure and fabricate products to conform with layout indicated on the Drawings. Install perpendicular and parallel to building lines except where noted otherwise. Abut joints tightly. Make cuts at ends neatly, square and angled to align with abutting construction.
B. Apply the rigid PVC framework system and attach securely with adhesive and staples at 2” o.c. in accordance with manufacturer's instructions. Install PVC components level, straight, flush and in proper alignment with adjacent surfaces.
C. Install acoustical wallboard within framework in largest sizes practical and attach to substrate with staples and manufacturer's recommended adhesive. Abut edges of boards and align all faces for smooth appearance.
D. Follow slope of ceilings precisely to align with geometry of underlying construction.
E. Install and stretch fabric in accordance with manufacturer's printed instructions for a smooth, wrinkle-free appearance. Run fabric in same direction relative to ceiling slope throughout the ceiling area. Provide fabric in a single piece for each ceiling plane. Attach securely into locking jaws of PVC mounting system.
F. Where seams are required at changes in direction and intersections of sloped ceiling with horizontal upper portion, provide abutting sections tightly adjoined and consistent in appearance along their entire length. Align seams between adjacent spaces for consistent appearance throughout.
G. Cut fabric from rolls, maintaining sequence of drops and matching direction of weave.
H. Install fabric into locking jaws of track. Stretch fabric taut, aligning fabric weave parallel to orthogonal planes of adjacent construction.

3.03 CLEANING & PROTECTION

A. Clean installed Work in accordance with manufacturer's instructions.
B. Trim and remove all loose fabric threads.
C. Protect finished Work from damage or soiling until Substantial Completion.
D. Instruct Owner in the proper care and maintenance of the finished installation.

END OF SECTION

SECTION 09 56 16 – METAL TEXTURED CEILINGS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Repair and restoration of the original metal textured ceiling panels and crown moulding where indicated in the Drawings.
   2. Remove, salvage and relocate existing metal ceiling for reinstallation in the reconfigured Lower Lobby where shown.
   3. Remove paint from existing metal ceiling using dry ice blasting or other non-abrasive, non-toxic system of removal that is suitable for textured metal.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 02 41 00 Demolition.
   2. Section 06 20 23 Interior Finish Carpentry.
   3. Section 09 21 16 Gypsum Board Assemblies.
   4. Section 09 90 00 ***Paintings & Coating (Filed Sub-Bid).
   5. Section 09 51 00 Acoustic Ceilings.
   6. Section 23 00 00 ***HVAC (Filed Sub-Bid).
   7. Section 26 00 00 ***Electrical (Filed Sub-Bid).

1.04 SUBMITTALS

A. Submit for approval product data, samples and installation instructions for each product type.

1.05 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers that have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Dry ice blasting specialized tradesmen shall demonstrate proficiency in the use of blasting equipment and materials. Provide a list of similar projects and references for review by the Architect. Personnel shall have a minimum of five years experience and be certified by the equipment manufacturer in its proper and safe use.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Metal Textured Ceilings: Re-use existing and relocate salvaged portions of existing panels and shaped profiles to repair or replace damaged components. No new materials, other than fasteners and patching compounds, will be required.
B. Paint Removal: Dry ice pellets, specialized equipment, protection and clean up.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Inspect ceiling conditions in the area of restoration as indicated in the Drawings.
B. Salvage replacement components from adjacent areas where continuing visible exposure is not indicated due to construction layout revisions.
C. Refasten wood strapping in the area of Work where panels are damaged or require removal for repairs and restoration.
D. Attach replacement components with flat head or rounded nails to match original fasteners in terms of head shape, head diameter, shaft length and materials.
E. Small areas of damage may be patched using compatible fillers and compounds, sanded, smoothed or textured to match adjacent appearance.
F. Remove all previous layers of paint from the surface of the metal textured ceiling, leaving all surfaces ready for priming painting by others.
G. Clean repaired ceiling and surrounding areas of the Work upon completion. Replace any damaged components.

END OF SECTION

SECTION 09 64 00 – WOOD FLOORING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Vapor block coating on ground floor slab.
   2. Double layer of 3/8" plywood floating subfloor over coated ground floor slab.
   3. Maple tongue-and-groove flooring, including installation of building paper and sealing of finished floor.
   4. Repair and refinishing of existing maple flooring.
   5. Reshaping existing wood thresholds and portions of new wood thresholds where indicated; refinishing and/or finishing thresholds to match flooring.
   6. Final wood floor re-conditioning treatment prior to Substantial Completion.
   7. Miscellaneous work as noted on the Drawings or required for a complete project.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this Section include, but are not limited to, the following:
   1. Section 02 41 00 Demolition.
   2. Section 03 30 00 Cast-in-Place Concrete.
   3. Section 06 10 00 Rough Carpentry.
   4. Section 06 20 23 Interior Finish Carpentry.

1.04 SUBMITTALS

A. General: Refer to Section 01 30 00 – Submittal Procedures for submittal provisions and procedures as applicable for the work of this Section. Provide samples of wood flooring in quality and dimensions specified.
B. Product Data: Submit complete product data sheets and recommendations for preparation, application and curing. Products shall comply with all applicable regulations, including compliance with VOC requirements.
C. Qualifications & Experience: Project experience of company and personnel performing the work under this Section shall demonstrate at least five (5) years experience with similar work as that required. If requested by Architect, submit project list and current phone numbers of references.
D. MOCK-UP: Prepare a mockup of wood flooring finish to demonstrate color and sheen prior to installation. Provide specified number of coats of finish in the mockup.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver finishing materials to site in manufacturer's original and unopened containers and packaging, bearing labels as to type and names of products and manufacturers.

B. Store finishing materials in designated areas only and in compliance with the manufacturer's requirements for ventilation, and temperature ranges and other conditions. Keep finishing materials in tightly closed containers and away from open flames.
C. Discard and remove from the job site any materials damaged in handling and storage and any materials that have been subjected to conditions contrary to manufacturer's recommendations.
D. Store wood flooring in a dry, level and conditioned space within the building.

1.06 PROJECT CONDITIONS

A. When project site conditions are satisfactory, deliver flooring materials, separate into small lots and store in the rooms where it will be installed. Allow 4 to 5 days for the flooring to become acclimated to the site conditions. If flooring is packaged, open or remove packaging for acclimation.
B. From the time flooring is delivered and until occupancy, temperature and humidity should be maintained at or near occupancy levels. After occupancy, continue to control the environment. Extended times (more than 1 month) without HVAC controls can promote elevated moisture conditions that can adversely affect flooring.
C. Examine substrate to determine its satisfactory condition prior to the installation of products specified in this Section.
D. Wood flooring may only be installed when moisture content is between 8-12% and materials have acclimatized in the building for at least 48 hours.
E. Finish may only be applied to surfaces when air, surface and material temperature and moisture content are within the range approved by the manufacturers.
F. Scheduling & Coordination: Coordinate the Work of this Section with the Work of other Sections and with the schedule for completion of various areas as determined by the Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide Slab Coating:
   1. Vapor Block coating to reduce moisture transmission through concrete slab.
   2. Bostik "Slab-Cote," Laticrete "Vapor Ban Primer ER," or approved equal.
B. Plywood floating floor and building paper over vapor coated concrete slab.
C. Provide hard maple tongue-and-groove strip flooring to match cut and specie of existing; 2 1/4" x 3/4" in longest available lengths; "select and better" grade.
   1. Provide 3 1/4" wide boards for repairs in the oldest floor of the building located in the existing "Historical Commission" room on the south side of the 1848 Foyer.
D. Provide first-class quality sealing and finishing products as noted herein. Acceptable manufacturers and products include:
   1. Bona Traffic HD: www.bona.com/en-US/Bona-Professional.
   2. Rubio Monocoat: www.monocoat.us.
   3. DuraSeal: www.duraseal.com.
E. Basis of Design as described in this specification is for Bona Traffic HD for a commercial Environment. If an approved equal product is used, submitted installation methods and system components shall be used in accordance with the manufacturer's instructions.
F. Basis of Design sealer and finish products or equal:
   1. Waterborne Sanding Sealer: NaturalSeal as manufactured by Bona US.
      a. Ingredients: Water, polymeric resin, silica derivate, diethylene glycol monoethyl ether, and propylene glycol.
      b. Color: Milky white (wet).
      c. Clarity: Unfinished wood look. Clear when dry.

d. pH: 8.0.
e. Solids: 30 percent.
f. Density: 8.70 lbs per gal (1.04 s.g.).
g. US Regulatory VOC: 250 g/L.
h. Gloss Level: N/A.
i. Odor: Non-offending.
j. Stability: 1-year shelf life in unopened container.
k. Certification: GREENGUARD Certified for indoor air quality.
l. LEED: Complies with USGBC LEED low-VOC requirements.

2. Waterborne Finish: Bona Traffic HD as manufactured by Bona US.
   a. Ingredients: Water, Polymeric resins, and amorphous silica.
   b. Color: Milky white (wet).
   c. Clarity: Clear and colorless when dry.
   d. pH: 7.9.
   e. Solids: 34 percent (with hardener).
   f. Density: 8.70 lbs per gal (1.04 s.g.).
   g. US Regulatory VOC Compliant: less than 150 g/L (with hardener).
   h. Coefficient of Friction: Greater than or equal to 0.5.
   i. Gloss Level (60 degrees):
      1) Commercial Extra Matte: 7 to 10 percent.
      2) Commercial Satin: 15 to 20 percent.
      3) Commercial Semi-Gloss: 40 to 45 percent.
   j. Odor: Very slight non-offensive odor.
   k. Stability: 1-year shelf life in unopened container.
   l. Cure Time: 100 percent after 3 days
   m. Certification: GREENGUARD Certified Gold for indoor air quality.

PART 3 - EXECUTION

3.01 PREPARATION OF GROUND FLOOR SLAB

A. Examine flooring substrate conditions to verify that they are acceptable to the requirements of the product manufacturer.
B. Install vapor block coating over concrete slab on grade. Follow printed guidelines for preparation and application in installation instructions of the product manufacturer.
C. Top coat vapor block coating with fillers, leveling compound and patching compounds that are compatible with the resilient flooring manufacturer's adhesives.
D. Install double layer of floating plywood subfloor in accordance with the National Wood Flooring Association's most recently printed guidelines for wood flooring over concrete slabs on grade. Overlay with building paper.

3.02 INSPECTION & PREPARATION

A. Inspect surfaces upon which flooring will be installed. Report any unsatisfactory conditions that are the result of the work of other Sections in writing to the General Contractor.
B. Confirm compatibility of specified finishing system with materials and finishes. Notify General Contractor in writing of any discrepancy.
C. Inspect the subfloor carefully - tighten any loose boards over wood framing by face nailing with 6d to 8d flooring nails. Look for protruding nail heads or nails not driven down below the subfloor's surface; pull them out or counter-sink them with a nail set. Remove any staples or other foreign materials.
D. Allow wood flooring to acclimate to the environment per the publication's standards.
E. Coordinate timing of wood installation and finishing of MOCK-UP to allow time for review and approval.

F. Completely mask or otherwise protect areas adjacent to surfaces to be finished. Remove, mask or protect installed items that are attached to or in contact with surfaces to be finished. Sweep the floor clean immediately before sanding.
G. Invite the regional Manufacturer's Representative to attend a conference with the Architect, Owner, General Contractor and Flooring Subcontractor prior to the application of finish on the MOCK-UP.

3.03 INSTALLATION

A. Comply with the flooring manufacturer's written installation instructions and NOFMA/WFI Technical Services Bulletin "Installing Hardwood Flooring" published by the Wood Flooring Manufacturer's Association.
B. At butt joints between boards, provide tongue and groove engagement with a factory edge or slip-tongue.
C. Blind nail with 8d flooring nails at 10" on center. Confirm nail length at ground floor slab so that nails penetrate plywood subfloor but do not penetrate concrete slab.
D. If face nailing is necessary in any location, pre-drill pilot hole part way through the wood in a smaller diameter than the nail. Set nail head and fill divot.
E. Evenly distribute varied grain patterns throughout the floor area to avoid clusters of like-patterned boards.

3.04 SANDING & FINISHING OF FLOORS

A. Utilize drum sander, edger, scraper and hand sander in the direction of the grain. Begin with coarse open coat paper to prepare newly installed flooring and to remove previous finishes from existing floor. Sand floor level and smooth with first cut.
B. Proceed with medium and fine grit papers for subsequent cuts. Prior to fine grit cut, fill all holes, blemishes, cracks and imperfections with wood filler recommended by manufacturer of sealer and allow adequate time to fully cure.
C. Hand scrape and sand smooth all recesses, edges and corners to blend with surrounding areas.
D. Make final cut with 80 to 120 grit paper, then multidisc with 120 to 150 grit paper to burnish and reduce the amount of grain raise.
E. Sweep and vacuum all surfaces in order to remove all dust and residue from sanding. Wipe up all adjacent surfaces including walls, ceilings, windows, sills, doors, door frames, tops of baseboards and similar surfaces where dust may have collected.
F. Inspect the floor carefully prior to application of finish. Spot-fill missed cracks and nail holes and sand smooth when dry. Confirm with finish manufacturer that all fillers are compatible with finish materials.
G. Use a Tampico Brush on a buffer and vacuum thoroughly.
H. Tack with a dry Bona Microfiber Tacking Pad or cloth to remove dust.
I. Begin application of sealer and finish immediately after cleanup procedures have been completed.
J. Application of Sealer: one coat minimum, two coats maximum.
    1. Shake or stir well to mix before applying. Do not thin.
    2. Pour a 6 inch (152 mm) wide line of sealer along starting wall. Go with grain of wood.
    3. Using a Pre-Dampened Floor Coater: Draw floor coater forward with grain of wood, moving sealer toward opposite wall. To maintain a wet edge, hold the floor coater at a snowplow angle.
    4. At End of Each Run: Turn floor coater and pull it toward you through the puddle. Then pad out the floor coater parallel to the wet edge.
    5. Feather out all turns. Do not push too hard or fast to avoid drips flying off floor coater.
    6. Recommended Coverage Rate: 400 to 500 sq ft per gal (9.81 to 12.27 sq m per L).

7. Do not spread too thin. Uneven coverage can cause blotchiness or color variance.
8. Certain species may require a second coat to achieve desired appearance.
9. Drying: Allow each sealer coat to dry 2-3 hours. Recommended conditions: 65 to 80 degrees F (18.3 to 26.7 degrees C), 40 to 60 percent relative humidity.
    a. High humidity and/or low temperature conditions will extend the dry time.
10. For smoothest results, follow Bona's guidelines for "Intercoat Abrasion." At a minimum between coats, vacuum and tack thoroughly with a Bona MicroFiber Tacking Pad (dry or slightly dampened with water).

K. Application of Finish: three coats.
1. Mixing: Shake or stir well to mix before applying. Do not thin.
    a. Shake Bona Traffic HD finish (Part A) well for 30 seconds.
    b. Add Bona Traffic HD Hardener (Part B) to finish (Part A).
        i. 10.38 oz (294.3 grams) bottle of hardener activates 1 gallon (3.78 L) of finish.
        ii. To mix finish amounts of less than one gallon, use a 1:11.33 ratio.
    c. Immediately shake mixture vigorously for 30 to 45 seconds.
    d. Insert supplied filter into bottle.
    e. Let sit for 5 to 10 minutes before applying; product cannot be re-hardened.
2. Application:
    a. Apply finish going with grain of wood.
    b. Feather out each stroke to avoid applicator marks.
    c. Use manufacturer's recommended coverage rate of sq ft / gallon (sq m / L).
    d. Allow each coat to dry thoroughly. Recommended conditions of 65 to 80 degrees F (18 degrees C to 27 degrees C), and 40 to 60 percent relative humidity.
        i. Waterborne Finishes: 2 to 3 hours.
        ii. High humidity and/or low temperature conditions extend dry time.
        iii. Increased ventilation and airflow reduces dry time.
    e. For Smoothest Results: See "Intercoat Abrasion" subparagraph below. At a minimum between coats, vacuum and tack thoroughly with a Bona Microfiber Tacking Pad (dry or slightly dampened with water).
    f. Pot Life: The finish/hardener mixture must be used within 4 hours after it is mixed. Product properties are diminished after 4 hours.
        i. The finish and hardener can be mixed only one time.
        ii. Caution: To avoid pressure build-up, do not tightly recap finish/hardener mixture.
    g. Intercoat Abrasion: It is not necessary to abrade between Bona waterborne sealer and finish coats unless more than 48 hours has passed since the previous coat was applied.
        i. For Smoothest Results: Abrade between coats as necessary. Use multidisc Bona Diamond 180 to 240 grit abrasives with Bona Intermediate Pads.
        ii. Thoroughly clean abraded floor using Bona PowerScrubber or vacuum and tack with Bona Microfiber Tacking Pads (dry or slightly dampened with water).
        iii. When using solvent-based sealers, always, vacuum and tack before finish coats.
    h. Curing: Process varies depending on product. Floors may be walked on after 24 hours but remains susceptible to scuffing or marring until completely cured. Do not replace area rugs until the floor has fully cured. Do not install area rugs or walk-off mats until the floor has fully cured.

3.05 CLEANING AND PROTECTION

A. Keep project premises free of debris. Collect material that may constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Protect work adjacent to finishing operations from splatters and spills. Fully restore any damaged surfaces. Remove masking and protection of adjacent surfaces upon completion.
C. Protect finished flooring from damage during remainder of construction period. Perform any repairs to flooring that may occur prior to project completion, including refinishing in any areas if deemed necessary by the Architect for restoration of newly completed appearance.
D. Invite the regional Manufacturer's Representative to the site for a project completion review and to train the Owner in the proper care and maintenance of the floor.
E. When maintaining the floor, vacuum dirt from the surface and only mop when necessary. When mopping, use a damp mop with clean water (no added cleaners) and do not saturate the floor with water.
F. Do not use harsh cleaners, wax or wood soap on the floor.

END OF SECTION

SECTION 09 65 19 – RESILIENT TILE FLOORING

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Resilient tile flooring where indicated.
   2. Resilient wall base where indicated.
   3. Plywood underlayment installation and preparation for flooring over subfloors.
   4. Leveling compounds and adhesives.
   5. Adhesive bond testing.
   6. Protection of installed flooring for remainder of construction period.
   7. Cleaning, Initial Maintenance and Preparation for commercial traffic.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this Section. Other Sections that relate directly to work of this Section include, but are not limited to, the following:
   1. Section 02 41 00 Demolition.
   2. Section 03 30 00 Cast-in-Place Concrete.
   3. Section 06 10 00 Rough Carpentry.
   4. Section 06 20 23 Interior Finish Carpentry.
   5. Section 09 21 16 Gypsum Board Assemblies.
   6. Section 09 64 00 Wood Flooring.

1.04 SUBMITTALS

A. Submit to Architect for approval complete product data for all work of this Section. Data shall consist of complete product description, specifications, actual material samples with complete color range. Submit current Installation and Maintenance Manuals and any other relevant information. Submit sample of manufacturer's warranty.

1.05 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers that have been in satisfactory use in similar service for a minimum of three years. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Use experienced and certified installers certified by the manufacturer.
C. Provide materials and adhesives that do not contain asbestos.
D. Confirm compatibility of materials with all substrate conditions.

1.06 WARRANTY

A. Provide manufacturer's written warranty upon Substantial Completion. Manufacturer's warranty is in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.

1.07 EXTRA MATERIALS

A. Deliver to the Owner in clearly marked packages all unused (and of useful size) materials that were purchased for installation on the site but were not utilized.
B. Provide a minimum of ten percent (10%) of additional uncut materials for each color of resilient flooring products utilized in the project.

1.08 PROJECT CONDITIONS

A. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
B. Environmental Requirements/Conditions: In accordance with manufacturer's recommendations, areas to receive flooring shall be clean, fully enclosed, weathertight with the permanent HVAC set at a uniform temperature of at least 68 degrees F. The flooring material should be conditioned in the same manner. Maximum temperature should not exceed 100 degrees F after installation.
C. Finishing Operations: Install resilient flooring after finishing operations, including painting and ceiling operations, have been completed.

1.09 SEQUENCING AND SCHEDULING

A. Finishing Operations: Install flooring after finishing operations, including painting and ceiling operations, have been completed.

PART 2 – PRODUCTS

2.01 MATERIALS

A. RESILIENT RUBBER TILES:
   1. Rubber Tiles shall be 24" x 24" x 1/8" gauge with homogeneous patterning throughout the thickness of the tile; hammered texture; solid color.
   2. Materials shall be non-asbestos; Class I per ASTM E648 with 0.80 SCOF and 250 PSI static load resistance.
   3. Manufacturer and Product shall include, but not be limited to, Tarkett.
   4. A maximum of two colors will be selected from material samples.
B. WALL BASE:
   1. Vinyl Wall Base shall be 4" high x 1/8" thick, matte finish; cove base shall be provided where indicated on the Drawings.
   2. Base shall be in 48" long straight sections and corners shall be field-formed.
   3. Color will be selected by the Architect from the manufacturer's standards.
   4. Manufacturers and products shall include but not be limited to: Johnsonite or approved equal (Roppe, Burke).
C. Underlayment:
   1. APA rated underlayment A-C sanded face, exterior exposure, 3/4" thick tongue and groove.
   2. Building Paper: 15-pound asphalt felt underlayment.
D. Adhesive:
   1. Adhesive for resilient flooring products, wall base and transitions shall be as recommended in written installation guidelines the manufacturer.
   2. Use a notched trowel with the groove pattern specified by the manufacturer.

E. Miscellaneous Materials:
   1. Leveling Compound, Crack Fillers and Primers, if required, shall be of the type specified by the manufacturer based on use with their materials in the specific project conditions. Do not use gypsum-based patching and leveling compounds.
   2. Commercial Floor Products: cleaner, polish and sealer as recommended by the manufacturer for preparation of floor for commercial traffic.

PART 3 – EXECUTION

3.01 PREPARATION – GENERAL

A. Prepare floor surfaces to be smooth, rigid, level, permanently dry, clean and free of foreign materials such as dust, paint, grease, oils, solvent, curing and hardening compounds, sealers, previous adhesives or any other residues.
B. Conduct an adhesive bond mat test for proper bond before general installation.
C. Conduct a pre-installation meeting to verify project requirements, substrate conditions, product and colors, provision of extra materials, design layout, manufacturer's installation instructions and manufacturer's warranty requirements. Meeting shall be attended by General Contractor, Flooring Subcontractor, Owner's Representative and Architect. Meeting shall be scheduled at least seven days in advance to allow sufficient time for any corrective preparations if needed.
D. Adjacent Surfaces Protection: Protect adjacent work areas and finished surfaces from damage during product installation.

3.02 PREPARATION - WOOD SUBFLOORS

A. Examine flooring substrate conditions to verify that they are acceptable to the requirements of the product manufacturer.
B. Install plywood underlayment over building paper over securely fastened wood subfloors in areas to receive resilient flooring. Install immediately prior to application of finished flooring. Follow printed guidelines in most recent edition of APA "Installation and Preparation of Plywood Underlayment for Resilient Floor Covering." Fasten panels at recommended increments with 1 1/4" long ring nails at spacings noted in the APA publication. Fasten underlayment to subfloor only, avoiding attachment to underlying joists per APA guidelines.
C. Prepare underlayment with fillers, leveling compound and patching compounds that are compatible with the resilient flooring manufacturer's adhesives.

3.03 INSTALLATION

A. Comply with manufacturer's instructions and recommendations. Install in proper relation to adjacent work. Do not proceed with work unless the environmental conditions are within the tolerances specified by the product manufacturer. Acclimatize material to jobsite conditions a minimum of 72 hours prior to installation. Store products on site in accordance with manufacturers instructions.
B. Install flooring in uniform contact with substrate and with tight joints to adjacent flooring. Level the substrate below any flooring whose surface does not align with adjacent flooring. Place flooring in accordance with the Drawings or directives given by Architect. Review any proposed variations from the design intent of the Drawings in advance with the Architect.
C. Scribe, cut and fit flooring to butt tightly to vertical surfaces, permanent fixtures, pipes, edgings, thresholds, nosings and cabinets. Extend flooring into toe spaces, door reveals, closets and similar openings. Adhere flooring to substrate without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks or other surface imperfections. Lay material into adhesive and roll with 100 lb. roller.

D. Clean adhesive from surface of flooring following instructions for removal found on the adhesive label.
E. Do not expose tile to any foot traffic for 24 hours nor to any rolling load traffic for at least 72 hours after installation to allow setting and drying of the adhesive.
F. Prior to installation of vinyl wall base examine substrate conditions to assure that wall and floor planes are free from waves, distortions or other imperfections. Install base to minimize joints. Install base with joints as far from corners as practical. Cut edges plumb and square where abutting door frames and other adjacent construction.

3.04 CLEANING, PROTECTION & FINISHING

A. Clean all residue from adhesives and adjacent materials promptly. Correct any poorly executed or damaged areas. Sweep and vacuum floor after installation.
B. Protect the flooring in accordance with the manufacturer's recommendations with 1/4" minimum hardwood panels.
C. Initial Maintenance of Resilient Flooring – No Earlier than 72 Hours After Installation:
   1. Thoroughly sweep or vacuum the flooring to remove all loose dirt and grit.
   2. Prepare a cleaning solution using one of the manufacturer's recommended pH neutral cleaners. The dilution ratio shall depend upon light to heavy soil conditions. Follow the manufacturer's label instructions.
   3. Apply the cleaning solution with a nylon or rayon mop, or pump type sprayer. DO NOT FLOOD THE FLOOR.
   4. Let the cleaning solution dwell for 5 to 15 minutes (dwell time is based on soil conditions of the floor). DO NOT ALLOW THE SOLUTION TO DRY.
   5. Scrub the flooring using a single disc rotary machine (175 – 350 RPM) equipped with a 16 to 24 gauge nylon bristle brush. In small areas, use a deck brush attached to a handle.
   6. Remove the cleaning solution using a wet vacuum or a mop.
   7. Rinse the floor thoroughly with clean water. Allow the flooring to dry completely.
   8. The cleaning process may need to be repeated on heavily soiled floors.
D. Deliver extra materials to the Owner upon completion.

END OF SECTION

SECTION 09 90 00 – PAINTING & COATING

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 FILED SUB-BID

A. PAINTING & COATING is stipulated as a filed sub-bid under Part D, Item 2 of the General Bid Form in Section 00 41 13.
B. All sub-bids shall be submitted on the "Form of Sub-Bid" furnished by the Awarding Authority and contained in Section 00 41 13. Sub-bids shall be submitted in accordance with the provisions of Massachusetts General Laws, Chapter 149, Sections 44A-J inclusive.
C. Sub-bids must be filed with the Awarding Authority in a sealed envelope before the local time and the date stipulated in the "Advertisement for Bids" in Section 00 11 13.
D. Specified information relating to sub-bidders is set forth in the Contract Documents under the heading "Instructions to Bidders", in Section 00 21 13 and attention is directed thereto.
E. The Work of this Section is shown on the following Drawings:
   1. Inclusive of all Drawings listed on Drawing A-00 "Project Information" and in Section 00 01 15 "List of Drawing Sheets" in Division 00 of the Project Manual.

1.03 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Painting and coating all interior surfaces of new and previously painted rooms as scheduled, including walls, trim, ceilings, doors, frames, windows, and stairway components including handrails and brackets.
   2. Back-priming of exterior wood trim and shingle siding components, and of interior wood trim where installed against masonry or exterior wood-framed surfaces.
   3. Painting all surfaces of new and previously painted exterior wood siding, trim, windows, doors, shutters, cornices, eaves, signs, letters , handrails, guard rails, exposed wood decking and framing where applicable (First Floor Ell Entry), and all other newly installed and previously painted exterior items.
   4. Painting the repaired, exposed and relocated embossed metal ceiling system.
   5. Painting of exposed piping or conduit installed as part of the Work. Painting of previously installed exposed piping where extant and visible in finished spaces.
   6. Touch up priming of any factory primed products with damaged or missing paint.
   7. Other miscellaneous preparation and painting as indicated on the Drawings or as required by the Work for a completed project.
B. The following Work is specified in other Sections:
   1. Section 08 52 00 – Wood Windows: Removal of paint and refinishing of repaired and restored original window and frames. Shop priming of replacement wood window sills, frames and replicated sash. (Final painting and touch-up of factory finishes shall be performed by the Painting Subcontractor on site.)
   2. Section 09 56 16 – Metal Textured Ceilings: Removal of paint at a portion of the existing embossed metal ceiling that will be restored (dry ice removal specialty).

1.04 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 00 31 19 Existing Conditions.
   2. Section 01 35 43 Environmental Procedures.
   3. Section 02 41 00 Demolition.
   4. Section 02 82 00 Asbestos Abatement.
   5. Section 05 50 00 Metal Fabrications.
   6. Section 06 20 13 Exterior Finish Carpentry.
   7. Section 06 20 23 Interior Finish Carpentry.
   8. Section 07 92 00 Joint Sealants.
   9. Section 08 52 00 Wood Windows.
   10. Section 08 11 00 Metal Doors & Frames.
   11. Section 08 14 00 Wood Doors.
   12. Section 08 31 00 Access Doors and Panels.
   13. Section 08 90 00 Louvers and Vents.
   14. Section 09 21 16 Gypsum Board Assemblies.
   15. Section 09 56 16 Metal Textured Ceilings.
   16. Section 22 00 00 ***Plumbing (Filed Sub-Bid).
   17. Section 23 00 00 ***HVAC (Filed Sub-Bid).
   18. Section 26 00 00 ***Electrical (Filed Sub-Bid).

1.05 SUBMITTALS

A. General: Refer to Section 01 33 00 – Submittal Procedures for submittal provisions and procedures as applicable for the work of this Section.
B. Provide a minimum of 12” x 12” samples of each color type and coating system as selected by Architect.
C. Product Data: Submit complete product data sheets and recommendations for mixing, application and curing. Products shall comply with all applicable regulations, including compliance with VOC requirements. Submit manufacturer warranty information.
D. Qualifications & Experience: Project experience of company and personnel performing the work under this Section shall demonstrate at least five (5) years experience with similar work as that required. If requested by Architect, submit project list and current phone numbers of references.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site in manufacturer's original and unopened containers and packaging, bearing labels as to type and names of products and manufacturers.
B. Store materials in designated areas only and in compliance with the manufacturer’s requirements for ventilation, and temperature ranges and other conditions. Keep materials in tightly closed containers and away from open flames.
C. Discard and remove from the job site any materials damaged in handling and storage and any materials that have been subjected to conditions contrary to manufacturer’s recommendations.

1.07 PROJECT CONDITIONS

A. Environmental Requirements: Paint may only be applied to surfaces when air, surface and material temperature and moisture content are within the range approved by the manufacturers. Proceed with work only when existing and forecasted weather conditions permit work to be performed in accordance with the manufacturer’s requirements. Do not apply coatings during rain or snow or when humidity is in excess of manufacturer's recommended limit.

B. Prevent spillage of paint onto adjacent surfaces that may be exposed to damage or staining. Clean up spills and drips immediately and refinish any areas that are affected by the work of this Section.
C. Examine Substrate to determine their satisfactory condition prior to the installation of products specified in this Section.
D. Scheduling & Coordination: Coordinate the painting work with the Work of other Sections and with the schedule for completion of various areas as determined by the Contractor.
E. Note that some existing painted surfaces may contain lead. Take all necessary precautions during preparation of existing surfaces and conform to all applicable local, state and federal regulations. There is no need for lead abatement.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide first-class quality products for all systems by manufacturers noted, or approved equal. Match color chips to be selected by the Architect.
B. Colors may be selected from a range of manufacturer's standard colors and will not be limited to those of the particular manufacturer selected for use or specified below. Provide color matches to the selected colors and provide a record of the formulas and products for the Owner's future use.
C. Acceptable manufacturer for paint products include, but may not be limited to, Benjamin Moore (BM), Sherwin Williams, ICI Paints, Penefin and Minwax, subject to the provisions of "or equal" as described in the Contract Documents. Manufacturer's recommendations for preparation and use shall be followed for each application. In the event that a product specified below is not suitable for the substrate, notify the Architect in writing before proceeding and propose an alternate product selection. If any surfaces scheduled to receive oil-based coatings currently contain water-based coatings, propose alternative primer and finish coat products for those locations.
   1. Interior Metal (excluding restored metal ceiling):
      a. Primer: BM Acrylic Metal Primer P04.
      b. Finish: BM DTM Acrylic Gloss Enamel P28.
   2. Interior Wood:
      a. Primer: BM Fresh Start® All Purpose Alkyd Primer 024.
      b. Finish: BM Advance® Semi-Gloss Waterborne Interior Alkyd Paint 793.
   3. Interior Walls (except where noted otherwise):
      a. Primer: BM Fresh Start® Acrylic Primer 023.
      b. Finish: BM Advance® Satin Waterborne Interior Alkyd Paint 792.
   4. Interior Ceilings (except where noted otherwise):
      a. Primer: BM Fresh Start® Acrylic Primer 023.
      b. Finish: BM EcoSpec WB Silver Interior Latex, Flat Finish, 473.
   5. Interior Toilet Room Walls & Ceilings:
      a. Primer / Gypsum Wallboard: BM Fresh Start Acrylic Primer 023.
      b. Primer / Exposed Masonry: BM High-Build Acrylic Masonry Primer W068.
      c. Finish: Corotech Pre-Catalyzed Waterborne Epoxy V342, eggshell.
   6. Interior Toilet Room Trim and Wood Doors:
      a. Primer (except as noted): BM Fresh Start Acrylic Primer 023.
      b. Primer (piping & conduit): Corotech Waterborne Bonding Primer V175.
      c. Finish: Corotech Pre-Catalyzed Waterborne Epoxy V341, semi-gloss.
   7. Interior Wood Handrails:
      a. Minwax Water-Based Pre-Stain Wood Conditioner: one coat.
      b. Minwax Water-Based Stain: two coats.
      c. Minwax Water-Based Wipe-On Polyurethane: three coats, satin sheen.
   8. Interior Painted Wood Stair Risers:
      a. Primer: BM Latex Floor & Patio Enamel (122), Low Sheen.
      b. Finish: BM Latex Floor & Patio Enamel (122), Low Sheen.

9. Exterior Wood Doors & Frames:
    a. Primer: BM Fresh Start® Moorwhite® Penetrating Alkyd Primer 100.
    b. Finish: BM Aura® Waterborne Exterior Paint Semi-Gloss 632.
10. Exterior Wood Trim, Eaves, Windows & Frames:
    a. Primer: BM Fresh Start® Moorwhite® Penetrating Alkyd Primer 100.
    b. Finish: BM Aura® Waterborne Exterior Paint Semi-Gloss 632.
11. Exterior Wood Siding:
    a. Primer: BM Fresh Start® Moorwhite® Penetrating Alkyd Primer 100.
    b. Finish: BM Aura® Waterborne Exterior Paint Low Lustre 634.
12. Exterior Metal:
    a. Primer: BM Acrylic Metal Primer P04.
    b. Finish: BM DTM Acrylic Gloss Enamel P28.
13. Exterior Exposed Decking at First Floor Ell Entrance:
    a. Primer: Penefin Pro-Tech Cleaner.
    b. Finish: Penefin Architectural Grade TMF Hardwood Finish (matte).

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

A. Inspect surfaces to be painted and report any unsatisfactory conditions that are the result of the work of other Sections in writing to the General Contractor. Note that commencement of work on any surfaces indicates full acceptance of substrate conditions by the painter.
B. Arrange for Pre-Construction Conference with Contractor, Architect and Field Representative from selected manufacturer of coatings and removal systems. Review existing conditions and confirm best approach to preparation and application of products for longest lasting performance.
C. Comply with manufacturer's instructions and recommendations for preparation, priming and coating work. Confirm compatibility of specified paint with substrate and with previous finishes based on manufacturer’s recommendations. Notify General Contractor in writing of any discrepancy.
D. At existing previously painted areas to be repainted, remove any blistered or peeling paint to sound substrates. Sand and feather edges of paint layers to eliminate variations in the surface and possible shadow lines. Remove chalk deposits and mildew and wash all surfaces with mild detergent. Perform related minor preparation including provision of fillers and sealants. Spot prime bare areas and areas susceptible to bleed-through staining prior to full priming and painting as specified.
E. At existing embossed metal ceiling, paint will be removed under the Work of Section 09 56 16 – Metal Textured Ceilings. Inspect surfaces and confirm that bare metal is in good condition prior to application of priming and painting. Notify General Contractor in writing of any unsatisfactory conditions and do not proceed with the Work until corrections have been made.
F. Pre-prime all exterior wood to be installed. Prime all six sides and allow to cure prior to installation under the Work of other Sections.
G. Completely mask or otherwise protect areas adjacent to surfaces to be painted. Remove, mask or protect installed items that are attached to or in contact with surfaces to be coated.
H. Patch and repair any defects in existing surfaces. Fill all holes and imperfections with materials suitable for permanent bonding to the substrate. Sand smooth to blend with adjacent planes and to eliminate any irregularities or imperfections. Remove all dust from surfaces to be painted and from all surfaces adjacent to the work area.
I. Provide sealant at locations where dissimilar materials abut one another. Sealant shall be installed over backer rod where the depth of the joint exceeds the width. Tool sealant neatly and remove any spillage or overlap with adjacent surfaces that may affect finished appearance.

3.02 APPLICATION

A. Apply paint and coating products in strict accordance with manufacturer's printed instructions. Apply with adequate illumination and ventilation. Apply only when the temperature and humidity are within acceptable ranges as noted in the most recently published application instructions of the product manufacturer.
B. For application of specified coatings after priming, follow manufacturer's printed instructions for the timely application of multiple coats.
C. Provide an adequate number of finish coats to provide complete coverage, usually consisting of a minimum of two coats depending upon the product and application. The cost of providing more than two coats, if required for complete coverage, shall be included in the Contract Sum.
D. Lightly sand painted surfaces between coats. Vacuum surfaces free of loose particles prior to application of next coat.
E. Match approved color samples. Re-coat work which does not match or which shows loss of adhesion to substrate or previously painted surfaces. Should any final coat be deemed unsatisfactory, it shall be sanded and additional coats applied as necessary until satisfactory finish is achieved.
F. Apply products evenly and smoothly, free of runs, drips, sags, holidays, lap marks, air bubbles and pinholes in order to assure a smooth finish.
G. Unless noted otherwise, paint both sides of all doors and frames located in areas scheduled to be painted. Seal concealed edges of wood doors at top and bottom.
H. Prepare and paint any areas that are damaged or disrupted by the work of this contract utilizing materials and finishes that match adjacent undamaged surfaces in their entirety.

3.03 CLEANING AND PROTECTION

A. Keep project premises free of painting-related debris. Collect material that may constitute a fire hazard, place in closed metal containers, and remove daily from site.
B. Protect work adjacent to painting operations from paint splatters and spills. Immediately remove paint that falls on finished surfaces not scheduled to receive paint, using materials and techniques that will not damage affected surfaces. Fully restore any damaged surfaces.
C. Leave unopened or slightly used materials for the Owner in clearly marked containers. Place containers in an area designated by the Owner on site. Provide final painting schedule with list of products, finishes and colors utilized in the project.

3.04 CLOSE OUT DOCUMENTATION

A. Provide final color and products selections in a binder for the Owner's future reference. Colors and sheens shall be noted in a schedule that is keyed to the building's plans for reference locations and future maintenance.
B. Product information shall include information on cleaning and maintaining the painted and coating finishes.

END OF SECTION

SECTION 10 14 00 – SIGNAGE

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Salvage and re-install exterior painted historic marker at front façade.
   2. Provide temporary signage at construction gates on the temporary fencing notifying the public that the building is under construction and not open.
   3. The Contractor may, at its own option, provide signage to identify the project name, address and participants as noted in Section 01 50 00, subject to zoning bylaws and restrictions, including Historic Commission guidelines and all required approvals for exterior temporary signs.
   4. Provide emergency exit and fire extinguisher location signs for safety purposes within the building to the extent required for worker safety during construction.
B. The following work shall be done directly by the Owner:
   1. The Owner shall furnish and install interior (and limited exterior) wall-mounted signage in compliance with 521 CMR accessibility regulations prior to occupancy.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 01 50 00 Temporary Facilities and Controls.
   2. Section 02 41 00 Demolition.

1.04 SUBMITTALS

A. Shop Drawings: Submit shop drawings indicating layout, details, sizes, attachment methods, supports, locations, dimensions, colors and materials of any proposed temporary signage at the site.
B. Permit Approval: After review of exterior project signage, if any per Contractor's option, submit signage to the Town for approval per local regulations.

END OF SECTION

SECTION 10 21 13 – TOILET COMPARTMENTS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Provide toilet partitions, overhead braced, complete with doors, panels, stiles, headrails, hardware and accessories.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 06 10 00 Rough Carpentry.
   2. Section 06 20 21 Interior Finish Carpentry.
   3. Section 09 21 16 Gypsum Board Assemblies.
   4. Section 09 30 00 ***Tiling (Filed Sub-Bid).
   5. Section 09 51 00 Acoustical Panel Ceilings.
   6. Section 09 90 00 ***Painting and Coating (Filed Sub-bid).
   7. Section 10 28 13 Toilet Accessories.
   8. Section 22 00 00 ***Plumbing (Filed Sub-bid).

1.04 REFERENCES

A. National Fire Protection Association 101 Life Safety Code 1991 Edition. Chapters 5, 6, 8-30.
B. ANSI A117- 1986 *Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.*
C. ADA, *Accessibility Guidelines for Buildings and Facilities*, Federal Register Volume 56, Number 144, Rules and Regulations.
D. Massachusetts Architectural Access Board Regulations, 521 CMR.

1.05 SUBMITTALS

A. Product Data: Submit to Architect for approval complete product data for all work of this SECTION. Data shall consist of complete product description, specifications, catalogue cuts, maintenance and care instructions and any other relevant information.
B. Shop Drawings: Submit to Architect for approval complete shop drawings indicating layout, details, supports, location and relationship to adjacent construction.
C. Submit actual samples of surface material choices in manufacturer's standard colors for finish selection. Color brochures will not be accepted for color selection.
D. Submit full color chain for plastic laminate selection, not the limited standard selection options normally furnished by the Toilet Compartment manufacturer.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver items in manufacturer's original unopened protective packaging.
B. Store materials in original protective packaging to prevent physical damage or wetting.
C. Handle so as to prevent damage to finished surfaces.

1.07 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers that have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Provide toilet partitions and all related components from a single manufacturer.

1.08 GUARANTEE

A. Provide one-year guarantee that all hardware and mounting brackets will be free from defects in material and workmanship.
B. Provide ten-year limited warranty for panels, doors and stiles against breakage, corrosion, delamination and defects in factory workmanship.
C. Guarantees shall commence at Substantial Completion.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Provide water and fire-resistant (NFPA Class A, ASTM E-84) solid phenolic ceiling-hung toilet partitions.
B. Acceptable manufacturers shall be Bobrick Washroom Equipment, Inc., Bradley Corporation (Mills), Global Partitions, or approved equal.
C. Partition and Screen Components:
   1. Partitions — Overhead braced system by Bobrick Compact Laminate Duraline 1182 series, Bradley Sentinel 400 series, Global Black-Core Phenolic, or approved equal.
   2. Stiles — 3/4" (19mm) thick, solidly fused stiles with matte-finish high-pressure plastic laminate surfaces, colored face sheets, and black phenolic-resin core that are integrally bonded. Edges are black.
   3. Panels — 1/2" (13mm) thick, solidly fused panels with matte-finish high-pressure plastic laminate surfaces, colored face sheets, and black phenolic-resin core that are integrally bonded. Edges are black.
   4. Doors — 3/4" (19mm) thick, solidly fused doors with matte-finish high-pressure plastic laminate surfaces, colored face sheets, and black phenolic-resin core that are integrally bonded. Edges are black.
   5. Headrail: Extruded anodized aluminum headrail with anti-grip profile. Provide clamps for attachment to pilaster and stainless steel brackets to wall.
   6. Plastic Laminate Face – Single color to be selected from the full range of products offered by the plastic laminate company that is preferred to be used by the toilet compartment manufacturer (e.g. Wilsonart, Formica, Nevamar or similar); selection will not be limited to the few standard laminates generally offered for selection purposes by the toilet compartment manufacturer.
   7. Leveling Device — 3/16" (5mm) thick, corrosion-resistant, chromate-treated, double zinc-plated steel angel leveling bar bolted to stile; furnished with 3/8" (10mm) diameter threaded rods, hex nuts, lock washers, flat washers, spacer sleeves, expansion anchors, and shoe retainers.
   8. Shoe — 18-8 S, type-304, 22-gauge (0.8mm) stainless steel with satin finish; 4" (102mm) high.

9. Commercial Hardware — Hinges, door latches, door keepers, coat hooks, and mounting brackets constructed of 18-8 S, type-304, heavy-gauge stainless steel with satin finish. Threaded inserts factory installed for securing hinges and door latch. Theft-resistant, stainless steel pin-head, torx screws furnished for door hardware and all mounting brackets. Black rubber bumper on the latch serves as door bumper for in-swing door. Coat hook equipped with rubber bumper. Balanced hinge is adjustable to hold door of unoccupied toilet compartment partially open or fully closed. Toilet compartment door is locked from inside by sliding door latch into keeper. Locked compartment may be opened from outside by lifting door to disengage latch from keeper. Track of door latch prevents in-swing door from swinging out beyond stile.

D. Miscellaneous:
   1. Provide all anchors, fasteners and backing as recommended by manufacturer and as required by field conditions for a complete, secure and finished installation.

PART 3 – EXECUTION

3.01 INSPECTION

A. Check areas scheduled to receive partitions for correct dimensions, plumbness of walls and soundness of surfaces that would affect installation of mounting brackets.
B. Verify spacing of plumbing fixtures to assure compatibility with installation of toilet compartment panels.
C. Do not begin installation of toilet compartments until conditions are satisfactory.

3.02 INSTALLATION

A. Install compartments rigidly, straight, plumb, and level and in accordance with manufacturer's installation instructions.
B. Installation methods shall conform to manufacturer's recommendations for backing and proper support.
C. Conceal evidence of drilling, cutting, and fitting to room finish.
D. Maintain uniform clearance at vertical edge of doors.

3.03 ADJUSTMENT AND CLEANING

A. Adjust hardware for proper operation after installation.
B. Set hinge cam on in-swinging doors to hold doors open when unlatched.
C. Clean exposed surfaces of compartments, hardware and fittings.
D. Provide Manufacturer’s service and parts manual to the Owner upon completion of project. Train Owner in proper care, cleaning and maintenance.

END OF SECTION

SECTION 10 28 13 – TOILET ACCESSORIES

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Provide toilet accessories as required to complete the work of the Contract, as indicated on the Drawings and as specified herein.
   2. Coordinate placement of blocking in partitions for secure attachment of toilet accessories.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 06 10 00 Rough Carpentry.
   2. Section 06 20 21 Interior Finish Carpentry.
   3. Section 09 21 16 Gypsum Board Assemblies.
   4. Section 09 30 00 •••Tiling (Filed Sub-Bid).
   5. Section 09 90 00 ***Painting and Coating (Filed Sub-Bid).
   6. Section 10 21 13 Toilet Compartments.
   7. Section 22 00 00 ***Plumbing (Filed Sub-Bid).
   8. Section 26 00 00 ***Electrical (Filed Sub-Bid).

1.04 SUBMITTALS

A. Product Data: Submit to Architect for approval complete product data for all work of this SECTION. Data shall consist of complete product description, specifications, catalogue cuts, maintenance and care instructions and any other relevant information.
B. Shop Drawings: Submit to Architect for approval complete shop drawings indicating layout, details, supports, location and relationship to adjacent construction.
C. Coordinate receipt of toilet accessory information from Owner in a timely fashion to facilitate rough framing and layouts.

1.05 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. All surfaces shall be smooth and free of any sharp edges, corners or seams. Any units that fail to meet these criteria shall be repaired to the Architect’s satisfaction or be replaced.

PART 2 – PRODUCTS

2.01 MATERIALS

A. General: Provide accessories fabricated of type 304 stainless steel all-welded construction with satin finish except as noted otherwise. Acceptable manufacturers for items to be provided by General Contractor shall be Bobrick Washroom Equipment, Inc., Bradley Corporation, American Specialties, Inc., Koala Kare Products or approved equals. For establishment of product type and configuration, units from specific manufacturers have generally been designated below. Note that these designations are not intended to limit competition.

B. Accessory Schedule:
   1. Paper Hand Drying: Surface-mounted folded paper towel dispenser; Bradley "Diplomat Series" Model 2A10-11; 525 multi-fold or 400 C-fold paper towels.
   2. Soap Dispenser:
      a. Wall-Mounted: GOJO ES8 touch-free dispenser; 1,200ml refill with battery; ABS plastic; adhere to mirror above lavatory; Model 7730-01, white.
   3. Waste Dispenser: Free-standing units to be provided by Owner.
   4. Toilet Tissue Dispenser:
      a. Wall-Mounted: Bradley "Diplomat Series" dual-roll surface-mounted dispenser; Model 5A10-11; two-rolls 4 ½" wide by 5 ¼" diameter.
      b. Toilet Compartment Mounted: Bradley "Diplomat Series" to serve two compartments with two rolls each; Model 5A-20.
   5. Sanitary Napkin Receptacle:
      a. Wall-Mounted: Bradley 4722-15, surface-mounted; 22-gauge stainless steel all welded; satin finish; push flap door; removable waste container.
      b. Toilet Compartment Mounted: Bradley 4721-15 to serve two compartments.
   6. Mirror Unit: Provided under Section 08 80 00 - Glazing.
   7. Grab Bars: Bradley heavy-duty stainless steel 1.25" outside diameter bars model 832 with safety grip finish, concealed anchor plates, concealed mounting flanges and snap flange covers.
   8. Coat Hook: Ives solid brass coat hook No. 575; 7" high; finish bright chromium US 26 (Ives B26).
   9. Baby Changing Station: Koala Bear Care stainless steel Baby Changing Station in FDA-approved molded polyethylene clad in 304 brushed stainless steel with pneumatic cylinder concealed steel-on-steel hinge system, child protection straps, diaper bag hooks, sanitary liner dispenser; units to meet or exceed ASTM static load capacity requirements.
      a. Horizontal Unit: KB110-SSWM; surface-mounted.

C. Miscellaneous:
   1. Provide all anchors, fasteners and backing as recommended by manufacturer and as required by field conditions for a complete, secure and finished installation.
   2. Provide blocking within walls and install units.
   3. Provide keys in triplicate for any locks. Key all locks alike.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions and approved submittals.
B. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Check substrate material, blocking and mounting plates to be assured that they are plumb, square and securely attached to adjacent construction.
C. Clean and protect work from damage throughout the construction period. Restore any damaged finishes and replace any damaged devices. Test each device for proper operation.

END OF SECTION

SECTION 10 44 00 – FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Provide fire extinguishers in semi-recessed wall-mounted cabinets.
   2. Provide wall-mounted fire extinguishers and standard brackets.
   3. Provide wall-adhered stickers to identify location of wall-mounted extinguishers.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 01 73 29 Cutting and Patching
   2. Section 06 10 00 Rough Carpentry.
   3. Section 06 20 23 Interior Finish Carpentry.
   4. Section 09 21 16 Gypsum Board Assemblies.

1.04 SUBMITTALS

A. Product Data: Submit to Architect for approval complete product data for all work of this SECTION. Data shall consist of complete product description, specifications, catalogue cuts, maintenance and care instructions and any other relevant information.
B. Shop Drawings: Submit to Architect for approval complete shop drawings indicating layout, details, supports, location and relationship to adjacent construction.

1.05 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers that have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. All surfaces shall be smooth and free of any sharp edges, corners or seams. Any units that fail to meet these criteria shall be repaired to the Architect’s satisfaction or be replaced.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers
   1. Provide products from one of the following manufacturers or an approved equal.
      a. Larsen's Manufacturing Co.
      b. J.L. Industries, Inc.
      c. William Brothers Corporation of America
B. Fire extinguishers: UL listed and labeled units.
   1. Type 1: Multi-purpose dry chemical Type ABC, 10 lb.; series MP; provide in semi-recessed cabinet Larsen's "Medallion Series" with solid brass door & trim (US4), full acrylic vision panel and 2.5" rolled edge with recessed handle.
   2. Type 2: Multi-purpose dry chemical Type ABC, 10 lb., series MP; standard wall brackets.
   3. Type 3: Carbon dioxide Type BC, 15lb; series CD; locate in elevator machine room and near electrical panels; standard wall brackets.
   4. Refer to "FEX" on floor plans for locations. Review each proposed location with fire department to confirm placement prior to rough-in and installation.
C. Highly visible vertical format stickers for adherence to the wall surface above wall mounted fire extinguishers.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install wall-mounted fire extinguishers at locations and heights to be confirmed with and acceptable to authorities having jurisdiction. Provide sufficient blocking within the walls where required for solid attachment. Refer to the Drawings for recommended locations of fire extinguishers.
B. Install units plumb and level at locations indicated on the Drawings; mounting height shall be as specified by the manufacturer except where adjustments to this height are required due to the unavoidable constraints of surrounding features. Heights shall comply with accessibility regulations including the Massachusetts Architectural Access Board (521 CMR) and ADA.
C. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other Sections.
D. Restore damaged finishes and test for proper operation. Clean and protect work from damage.

END OF SECTION

SECTION 10 80 00 – OTHER SPECIALTIES

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to PART A, Division 00 and PART B, Division 01, as listed in the TABLE OF CONTENTS, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not necessarily limited to the following:
   1. Provide fixed stanchions, wall plates and control ropes in balcony.

1.03 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this SECTION. Other Sections that relate directly to work of this SECTION include, but are not limited to, the following:
   1. Section 01 73 29 Cutting and Patching
   2. Section 06 10 00 Rough Carpentry.
   3. Section 06 20 23 Interior Finish Carpentry.
   4. Section 09 21 16 Gypsum Board Assemblies.
   5. Section 09 64 00 Wood Flooring.

1.04 SUBMITTALS

A. Product Data: Submit to Architect for approval complete product data for all work of this SECTION. Data shall consist of complete product description, specifications, catalogue cuts, maintenance and care instructions and any other relevant information.
B. Shop Drawings: Submit to Architect for approval complete shop drawings indicating layout, details, supports, location and relationship to adjacent construction.

1.05 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers that have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. All surfaces shall be smooth and free of any sharp edges, corners or seams. Any units that fail to meet these criteria shall be repaired to the Architect’s satisfaction or be replaced.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers
   1. Provide products from one of the following manufacturers or an approved equal.
      a. Crowd Control Direct
      b. Stanchion World
      c. Global Industrial
B. Stanchions and Ropes: Based on Crowd Control Direct products.
   1. Fixed Base Post: 2” diameter stainless steel with 5” base flange; optional flange cover; ball finial top; hook attached at 30” AFF; black powder coat.
   2. Wall Plate: 2” x 1.5” surface mounted large rope wall plate; black powder coat.
   3. Ropes: 1.5” classic black velvet ropes of 72” standard length (4) and 39” custom (2); snap ends with black powder coat finish.
      a. Verify custom length portion prior to ordering so that curvature of attached custom and standard ropes match in height above finished floor at the low point of each rope.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install stanchions and wall plates at locations and heights as indicated and to be confirmed with and acceptable to authorities having jurisdiction. Provide sufficient blocking within the walls where required for solid attachment. Refer to the Drawings for recommended locations.
B. Install units plumb and level at locations indicated on the Drawings; mounting height shall be as specified except where adjustments to this height are required due to the unavoidable constraints of surrounding features.
C. Secure base flanges and wall plates with recommended countersunk wood screws into solid substrate for rigid attachment.
D. Install velvet ropes and provide protective sleeves to guard against damage and dust; leave sleeves in place until Substantial Completion.
E. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other Sections.
F. Restore damaged finishes and test for proper operation. Clean and protect work from damage.

END OF SECTION

SECTION 12 93 00 – SITE FURNISHINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. This section is only a portion of the Contract Documents. All of the Contract Documents, including Conditions of the Contract and Division 1 General Requirements, apply to this section.

1.02 DESCRIPTION OF WORK

A. The work of this section includes, but is not limited, to the following:

1. Metal Bike Rack

1.03 RELATED WORK

A. Carefully examine all the Contract Documents for requirements that affect the work of this Section. Other specification sections that directly relate to the work of this Section include, but are not limited to the following:

2. Section 012300 – Alternates
3. Section 024113 - Site Clearing and Preparation
4. Section 312000 - Earthwork
5. Section 321200 - Asphalt Paving
6. Section 321313 – Exterior Concrete

1.04 SUBMITTALS

A. Shop Drawings: Refer to individual site improvements for submittal requirements.

B. Provide manufacturer's product material information and system performance data along with material and system samples for each item specified in this Section for the Architect's review and approval prior to ordering materials.

C. The General Contractor shall verify by field inspection that all items within this section conform to the specified requirements and approved submittals prior to installation.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products and provide adequate protection against damage. Handle in strict compliance with manufacturer instructions and recommendations and store off the ground. Protect from all possible damage including, but not limited to chipping, staining, cracking and other damage. Sequence deliveries to avoid delays, but minimize on-site storage.

1.06 COORDINATION

A. The work of this Section shall be coordinated with that of other trades affecting, or affected by, this work as necessary to assure the steady progress of the work of this Contract.

B. Substrates: Proceed with work only when substrate construction and penetrating work is complete.

1.07 GUARANTEE

A. In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTARY GENERAL CONDITIONS, the Contractor shall provide the manufacturers' standard written warranty for each product within this specification. All of these guarantees shall be in addition to, and not in lieu of, other liabilities that the Contractor may have by law or other provisions of the Contract Documents.

PART 2 - PRODUCTS AND EXECUTION (Combined)

2.01 METAL BIKE RACK

A. Basis of Design is Model "BRCA-101 Bike Rack" by Victor Stanley (Quantity 3) with following specifications

1. Single loop bike rack constructed of 2.375 in (60 mm) OD tubular steel pipe. Sign panels shall be 16 gauge aluminum panels.

2. Powder coat over galvanized finish. Satin stainless-steel finish. Surface mount. In-ground mount.Letterform meeting referenced standards. Where no standard exists, letterform shall be as selected by the Architect.

3. Provide shop drawing submittal for bike racks.

B. Other Approved Manufacturers:
1. Model Cordia Bike Rack in natural corrosion resistant aluminum finish by Forms + Surfaces (www.forms-surfaces.com)
2. Model Iconic Bike Rack in Matte Gunmetal finish by Maglin (www.maglin.com)

2.03 CLEANING, REPAIR AND PROTECTION

A. Repair minor damage to eliminate all evidence of repair. Remove and replace work that cannot be satisfactorily repaired.

B. Provide temporary protection to ensure that the work will be without dirt, stains, damage or deterioration at time of final acceptance. Clean up stains and spills as they occur. Remove protections and clean as necessary immediately before final acceptance.

END OF SECTION

SECTION 14 26 00 – LIMITED USE/LIMITED APPLICATION ELEVATORS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to Division 00 and Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 FILED SUB-BID

A. LU/LA ELEVATORS is stipulated as a filed sub-bid under Part D, Item 2 of the General Bid Form in Section 00 41 13.
B. All sub-bids shall be submitted on the "Form of Sub-Bid" furnished by the Awarding Authority and contained in Section 00 41 13. Sub-bids shall be submitted in accordance with the provisions of Massachusetts General Laws, Chapter 149, Sections 44A-J inclusive.
C. Sub-bids must be filed with the Awarding Authority in a sealed envelope before the local time and the date stipulated in the "Advertisement for Bids" in Section 00 11 13.
D. Specified information relating to sub-bidders is set forth in the Contract Documents under the heading "Instructions to Bidders", in Section 00 21 13 and attention is directed thereto.
E. The Work of this Section is shown on the following Drawings:
   1. Inclusive of all Drawings listed on Drawing A-00 "Project Information" and in Section 00 01 15 "List of Drawing Sheets" in Division 00 of the Project Manual.

1.03 WORK INCLUDED

A. Provide labor, materials and equipment necessary to complete the Work of this Section, including but not limited to the following:
   1. Limited Use/Limited Application pre-engineered hydraulic passenger elevator.
   2. Elevator car enclosure, hoistway entrances and signal equipment.
   3. Drive system.
   4. Operation and control systems.
   5. Accessibility provisions for physically disabled persons.
   6. Equipment, machine, controls, systems and devices as required for safely operating the specified elevator at its rated speed and capacity.
   7. Materials and accessories as required to complete the elevator installation.
   8. Cooperation and coordination with all related trades for the provision of fire alarm, temperature control, power and damper operation for hoistway venting, including the elevator personnel and time required for temporary elevator operation and hoistway access by other trades during construction.

1.04 RELATED WORK

A. Examine the Contract Documents in their entirety for requirements that affect the work of this Section. Other Sections that relate directly to work of this Section include, but are not limited to the following:
   1. Division 03 Concrete:
      a. Concrete foundation and pit.
      b. Installing inserts, sleeves and anchors in concrete.
   2. Division 04 Masonry:
      a. Reinforced opening into existing chimney for venting of hoistway.
   3. Division 06 Wood, Plastics and Composites:

a. Rough framing of hoistway openings in floors.
b. Rough framing of hoistway walls and landing door openings.
c. Rough framing of elevator machine room and vent openings.

4. Division 07 Thermal & Moisture Protection:
   a. Waterproofing of elevator pit.
   b. Insulation in hoistway walls for sound reduction.
   c. Sealants at vent openings, framing members and finish materials.
5. Division 08 Openings:
   a. Door, frame and hardware to elevator machine room.
6. Division 09 Finishes:
   a. Gypsum wallboard over stud-framed hoistway walls.
   b. Field painting of any unfinished or shop-primed ferrous materials.
   c. Carpet tiles and transition strip for finished floor in elevator cab.
7. Division 10 Specialities:
   a. Fire extinguisher in elevator machine room.
   b. Signage for elevator machine room per building standards.
8. Division 23 HVAC:
   a. Heating, cooling and ventilating of hoistway and machine room.
9. Division 26 Electrical:
   a. Providing electrical service to elevator, including fused disconnect switches.
   b. Auxiliary contacts for battery-powered lowering of cab.
   c. Heat and smoke sensing fire alarm systems and interconnecting devices.
   d. Convenience outlets and illumination in machine room, hoistway and pit.
   e. Telephone service.

1.05 SUBMITTALS

A. Submit the following information in accordance with Section 01 33 00 Submittals.
   1. Product Data:
      a. Elevator car enclosure and hoistway entrances.
      b. Operation, control, and signal systems.
      c. Preparation instructions and recommendations.
      d. Storage and handling requirements and recommendations.
      e. Installation methods.
   2. Shop Drawings:
      a. Show equipment arrangement in the machine room, pit and hoistway. Provide plans, elevations, sections and details of assembly, erection, anchorage, and equipment location.
      b. Indicate elevator system capacities, sizes, performances, safety features, finishes and other pertinent information.
      c. Show floors served, travel distances, maximum loads imposed on the building structure at points of support and all similar considerations of the elevator work.
      d. Indicate electrical power requirements and branch circuit protection device recommendations.
      e. Cab interior floor plans, reflected ceiling plan and all four interior elevations with materials, finishes, dimensions and devices noted.
   3. Color selection: Two complete sets of actual samples of exposed finishes and materials for color selection.
      a. Color charts of material finish choices will not be acceptable as a substitute for chips of actual materials.
   4. Certificates: Inspection and acceptance certificates of elevator system installation.
   5. Operation and Maintenance Data:
      a. Operation and maintenance instructions.
      b. Parts list, with recommended parts inventory.
      c. Warranty and maintenance service contract.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: An approved manufacturer regularly engaged in manufacturing, installing, and servicing elevators of the type required for the project.
   1. The manufacturer of the machine, controller, signal fixtures, door operators cab, entrances, and all other major parts of the elevator operating equipment.
B. Installer Qualifications: The manufacturer or an authorized agent of the manufacturer with not less than ten (10) years of satisfactory experience installing elevators equal in character and performance to the project elevator.
C. Regulatory Requirements:
   1. ASME A17.1 Safety Code for Elevators and Escalators, latest edition or as required by the local building code.
   2. 524 CMR Massachusetts State Elevator Regulations.
   3. 780 CMR – Massachusetts State Building Code.
   4. NFPA 70 National Electrical Code.
   5. 527 CMR Massachusetts State Electrical Code.
   6. NFPA 80 Fire Doors and Windows.
   7. Americans with Disabilities Act - Accessibility Guidelines (ADAAG).
   8. 521 CMR Massachusetts State Access Board Regulations.
D. Fire-rated entrance assemblies: Opening protective assemblies including frames, hardware, and operation shall comply with ASTM E2074, CAN4-S104 (ULC-S104), UL10(b), and NFPA Standard 80. Provide entrance assembly units bearing Class B or 1 1/2 hour label by a Nationally Recognized Testing Laboratory.
   1. Class C or 45-minute label is acceptable if available since the hoistway will be one-hour rated as required for conformance with code.
E. Inspection and testing: Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
   1. Arrange for inspections and make required tests.
   2. Deliver to the Owner upon completion and acceptance of elevator work.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver elevator materials, components and equipment in manufacturer's protective packaging.
B. Store materials in a dry protected area provided by others. Protect and handle materials in accordance with manufacturer's recommendations to prevent damage, soiling, or deterioration.

1.08 PROJECT CONDITIONS

A. Elevators shall not be used for any purpose, including hoisting of materials and personnel, during the construction period before Substantial Completion.
B. Painting:
   1. Except as otherwise specified, paint all unfinished metal work provided by the elevator manufacturer and installer.
   2. Provide all ferrous metals installed in the hoistway shop primed with a rust inhibitive primer.

1.09 WARRANTY

A. Warranty: Submit elevator manufacturer's standard written warranty agreeing to repair, restore or replace defects in elevator work materials and workmanship not due to ordinary wear and tear or improper use or care for 24 months (two years) from date of Substantial Completion as established by the Architect. Warranty shall include cost of parts and labor.

1.10 MAINTENANCE

A. As part of the initial installation cost, include the cost of maintenance (parts + labor) and call back service for a period of 24 months from the date of Substantial Completion as established by the Architect. Service shall consist of periodic examination of the equipment, adjustment, lubrication, cleaning, supplies and parts to keep the elevator in proper operation.
   1. Maintenance work shall be performed by trained employees of the elevator contractor. Call back repair service shall be responded to within 48 hours of the request and shall be performed by trained employees familiar with the elevator.
   2. Submit parts catalog and show evidence of local parts inventory with complete list of recommended spare parts. Parts shall be produced by manufacturer of original equipment.
   3. Manufacturer shall have a service office and full time service personnel within a 50 mile radius of the project site.
   4. The service contract shall include the re-inspection of the elevator at the end of the first and second years. The cost of the state's inspection certificates for initial inspection and for re-inspection at the end of the first and second years (three inspections total) shall be included in the cost of the service contract.

1.11 PLANNING AND PRE-INSTALLATION COORDINATION MEETINGS

A. Meet with the General Contractor prior to the start of construction in order to verify the project requirements in relation to the selected elevator and its pit, hoistway, over-run clearance requirements, machine room layout and venting.
B. Construction documents have been based on the provisions of Garaventa's elevator equipment in compliance with their experience in Massachusetts. If the selected equipment manufacturer's requirements differ from the project requirements, those variations must be fully feasible to construct, without undue hardship on adjacent spaces, and any variation in the cost of the project must be fully accounted for in the Contract Sum proposed by the Bidder. Furthermore, the General Contractor shall be responsible, in coordination with the Elevator Subcontractor and other trades, to revise and update the Drawings and Specifications to properly reflect any adjustments, subject to the approval of the Architect and Owner.
C. Upon completion of the hoistway, pit and machine room construction and preparation of related components by other trades, meet with the General Contractor prior to elevator installation in order to confirm and verify project readiness.

PART 2 - PRODUCTS

2.01 MANUFACTURER AND DESCRIPTION

A. Provide products manufactured by one of the following three manufacturers, or an approved equal:
   1. Basis of Design: Garaventa USA – Elvoron LU/LA; http://www.garaventausa.com
   2. ThyssenKrupp Access – Evolution LU/LA; http://www.thyssenkruppelevator.com/
   3. Schumacher USA – LU/LA; http://www.schumacherelevator.com
B. Elevator system controls and equipment shall be non-proprietary:
   1. Equipment shall be universally maintainable.
   2. Diagnostics shall be built into the system.
   3. A proprietary tool shall not be required for adjustment or maintenance.
   4. Technical training shall be available to all qualified personnel.
   5. Engineering and technical support shall be available to all qualified personnel.
   6. All required system manuals and drawings shall be provided.
   7. The control manufacturer shall provide direct support to the "end user" and their designated maintenance company.
   8. Parts shall be available for inventory, not just for exchange.
C. Elevator Description:
   1. One (1) limited use, limited application hydraulic elevator.

2. Rated Capacity: 1,400 lbs.
3. Rated Speed: 30 ft./min.
4. Travel: Approximately 10'-0" to be verified in the field.
5. Landings: 3 total
6. Openings: Front: 2; Side: 1
7. Clear Car Inside: 4'-3" wide x 4'-3" deep.
8. Hoistway Entrance Size: 3'-0" wide x 6'-8" high.
9. Door Type: Two- speed horizontal sliding.
10. Power Characteristics: 208 volt, 3 Phase, 20 amp.
11. Lighting Power: 110VAC, single phase, 15 amps.
12. Seismic Requirements: Zone 2 (verify).
13. Fixture & Button Style: Traditional.
14. Pit Depth: 35" (24" min. clear req'd below cab; < 36" deletes need for pit ladder).
15. Total Overhead: 135" above upper landing for provision of refuge space.
16. Drive System: 1:2 Cable Hydraulic, Heavy Duty car sling with roller guide shoes running on 8 lb. per foot steel T-rails, Quiet submersed pump and motor (5 HP), Factory pre-set and tested 2-speed valve for smooth start and stop.
17. Controls:
    a. PLC Controller with integrated self diagnostics.
    b. Fully automatic push button at car and landings with Braille markings.
    c. Automatic car light switch upon entry.
    d. Digital floor indicator in car and in each hall call station at landings.
    e. Car arrival lanterns in car door jamb.
    f. Arrival Gong.
18. Safety Features:
    a. Emergency back-up power with a manual lowering device.
    b. Safety brake system.
    c. Car operator with integral gate switch.
    d. Automatic bi-directional floor leveling.
    e. Emergency alarm button in car, Emergency keyed stop switch in car.
    f. Overspeed valve.
    g. Final limit switch.
    h. Low oil protection timer circuit.
19. Features:
    a. Car direction lantern comes with audio and visual signals.
    b. Full height photo-electric door sensors.
    c. Automatic home park feature (can be disengaged during installation if desired).
    d. Integrated hands free telephone.
    e. Fireman Service (Phase 1).
    f. Keyed hoistway access.

2.02 MATERIALS, GENERAL

A. Colors, patterns, and finishes shall be as selected by the Architect from the product manufacturer's full range of standard colors, patterns, and finishes.

2.03 CAB DESIGN

A. Cab Design:
1. Interior Walls: Laminate panel sections per manufacturer's standards.
    a. Color to be selected.
2. Cab Frame
    a. Mild steel powder coated black.
3. Ceiling Finish:
    a. Stainless Steel, brushed finish.
4. Handrail Finish:
    a. Stainless steel, brushed finish.

5. Car Operating Panel Finish:
   a. Stainless steel, brushed finish.
6. Floor: Unfinished plywood with finished flooring by others (carpet tiles as specified in Section 09 68 00 - Carpeting).
7. Lighting: Four recessed LED down lights.
   a. Black Trim.
8. Car Direction Lantern: Stainless car direction lantern complete with auto and visual signaling device indicating direction of travel and arrival at selected floor.
9. Car Doors: When open the doors provide a 36 inch (915 mm) by 80 inch (2032 mm) clear opening.
   a. Two Speed Horizontal Sliding with full height photo-electric door sensors.
   b. Stainless steel, brushed finish.

2.04 HOISTWAY ENTRANCES

A. Hoistway Entrances: When open the doors provide a 36 inch (915 mm) by 80 inch (2032 mm) clear opening.
   1. Two Speed Horizontal Sliding with full height photo-electric door sensors.
   2. Stainless steel, brushed finish.
B. Hall Call Stations:
   1. Type: Keyed Push Button.
   2. Finish: Antique black.
   3. Digital with floor indicator.
   4. Jamb mounted floor designation markings per 521 CMR.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Before starting elevator installation, inspect hoistway, hoistway openings, pits and machine rooms, as constructed, verify all critical dimensions, and examine supporting structures and all other conditions under which elevator work is to be installed. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.
B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 INSTALLATION

A. Install elevator systems components and coordinate installation of hoistway wall construction.
   1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1, manufacturer's installation instructions and approved shop drawings.
   2. Comply with the National Electrical Code for electrical work required during installation.
B. Perform work with competent, skilled workmen under the direct control and supervision of the elevator manufacturer's experienced foreman.
C. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports, and bracing including all setting templates and diagrams for placement.
D. Coordination: Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by the Contractor, to ensure dimensional coordination of the work.
E. Install machinery, guides, controls, car and all equipment and accessories to provide a quiet, smoothly operating installation, free from side sway, oscillation or vibration.

F. Sound isolation: Mount rotating and vibrating elevator equipment and components on vibration-absorption mounts, designed to effectively prevent the transmission of vibrations to the structure, and eliminate sources of structure-borne noise from the elevator system.
G. Alignment: Coordinate installation of hoistway entrances with installation of elevator for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum safe, workable dimensions at each landing.
H. Erect hoistway sills, headers, and frames before erection of rough walls and doors; erect fascias and toe guards after rough walls are finished. Set sill units accurately aligned and slightly above finish floor at landings.
I. Lubricate operating parts of system, as recommended by manufacturer.

3.03 FIELD QUALITY CONTROL

A. Acceptance testing: Upon completion of the elevator installation and before permitting use of elevator, perform acceptance tests as required and recommended by Code and governing regulations or agencies. Perform other tests, if any, as required by governing regulations or agencies.
B. Advise Owner, Contractor, Architect, and governing authorities at least 72 hours in advance of dates and times that acceptance tests are to be performed on elevator.

3.04 ADJUSTING

A. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

3.05 CLEANING

A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided.
B. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoistway. Remove trash and debris.

3.06 PROTECTION

A. At time of Substantial Completion of elevator work, or portion thereof, provide suitable protective coverings, barriers, devices, signs, or other such methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

3.07 DEMONSTRATION

A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.
B. Make a final check of elevator operation, with Owner's personnel present, immediately before date of Substantial Completion. Determine that control systems and operating devices are functioning properly.
C. Immediately upon acceptance of the elevator by the State Inspector, allow the Owner full use of the elevator unless the rest of the project is not yet substantially completed and ready for occupancy.

END OF SECTION

DIVISION 22

SECTION 220000

PLUMBING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Include GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS and applicable parts of Division 1 as part of this Section.

B. Examine all other Sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 WORK INCLUDED

A. The work under this Section shall include the furnishing of all material, labor, equipment and supplies and the performance of all operations to provide a complete working system as required by the Drawings and details and as specified herein, in general, to include the following items:

1. Domestic cold water system.

2. Domestic hot water supply and hot water recirculation system.

3. Sanitary, waste and vent system.

4. Core Drilling.

5. Insulation of all existing cold water, hot water, hot water recirculation and conductors systems piping, valves and fittings made bare as a result of asbestos abatement. When connecting to existing insulated systems provide new insulation for three feet on either side of the new connection.

6. Furnishing of access panels.

1.03 RELATED WORK IN OTHER SECTIONS

A. The following work is not included as work in this Section and is to be performed under other Sections:

1. All Cutting and Patching.

2. Temporary Water, Heat, Fire Protection and Toilet Facilities.

3. Temporary Light and Power.

4. Foundations and Trenching.

5. Concrete Bases for Equipment.

6. Flashing and Caulking.

7. Painting.

8. Heating, Ventilating and Air Conditioning.

9. Fire Protection.

10. Electrical.

11. Concrete Basins and Pits.

12. Installation of Access Panels.

13. Toilet Room Accessories.

1.04 CODES, STANDARDS AND REFERENCES

A. All materials and workmanship shall comply with the latest editions of all applicable Codes, Local and State Ordinances, Industry Standards and Regulations.

B. The Plumbing Subcontractor shall notify the Architect/Engineer of any discrepancies between the Contract Documents and applicable Codes, Standards, etc.

C. In the event of a conflict, the most stringent requirements shall apply.

D. The following Codes, Standards and References shall be utilized as applicable:

1. State Building Code.

2. National Electric Code (NEC).

3. Environmental Protection Agency (EPA).

4. Department of Environmental Protection (DEP).

5. Local Ordinances, Regulations of the City or Town.

6. National Fire Protection Association (NFPA).

7. Insurance Services Organization (ISO).

8. American National Standards Institute (ANSI).

9. American Society of Mechanical Engineers (ASME).

10. American Society of Testing Materials (ASTM).

11. American Welding Society (AWS).

12. Commercial Standards, U.S. Department of Commerce (CS).

13. Industrial Risk Insurers (IRI).

14. National Electrical Manufacturers Association (NEMA).

15. Underwriters' Laboratories, Inc. (UL).

16. Massachusetts Uniform State Plumbing Code.

17. Massachusetts Fuel Gas Code.

18. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).

19. Massachusetts Water Resource Authority (MWRA).

20. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS).

21. Architectural Access Board (AAB).

22. Americans with Disabilities Act (ADA).

23. Reduction of Lead in Drinking Water Act.

1.05 OBTAINING INFORMATION

A. Obtain from the manufacturer the proper method of installation and connection of the equipment that is to be furnished and installed. Obtain all information that is necessary to facilitate the work and to complete the project.

B. Prior to performing any new work, uncover, locate and determine the routing, size, material and direction of slope of all existing systems to be connected to. The invert elevation of the existing drains and sewers must be established prior to any slab cutting for new systems.

1.06 COOPERATION AND COORDINATION WITH OTHER TRADES

A. The Contract Drawings are diagrammatic only intending to indicate general routing and location of piping and equipment. The Drawings are not intended to show every offset and accessory required, nor every structural difficulty that may be encountered.

B. Where requirements of the applicable codes, plans and/or specifications are in conflict, the most stringent requirement will be included in the Contract. Prior to ordering and/or

installing any portion of the work which appears to be in conflict, the work shall be brought to the Architect/Engineer's attention for direction as to what is provided.

C. Final location of plumbing fixtures and other pieces of equipment, whether or not furnished by the Plumbing Subcontractor, requiring plumbing services shall be coordinated with the Architectural Plans. Additional offsets, fittings, etc., shall be provided as needed to meet this requirement at no extra cost to the Owner.

D. If discrepancies exist in the scope of work as to what trade provides items, they shall be reported to the Architect/Engineer prior to signing the Contract. If the discrepancies are not reported, the Plumbing Subcontractor shall furnish such items as needed for a complete and operable system.

E. All work shall be installed in cooperation with other trades.

F. Keep fully informed as to the shape, size and position of all openings required for all apparatus and give information in advance to build openings into the work. Furnish and set in place all sleeves, pockets, supports and incidentals.

G. All distribution systems which require pitch or slope such as plumbing drains, steam and condensate piping shall have the right of way over those which do not. Confer with other trades as to the location of pipes, ducts, lights and apparatus and install work to avoid interferences.

H. Prepare and submit for review, coordinated Plans and sections, clearly showing how the work is to be installed in relation to the work of other trades. Work that is installed before coordination with other trades, or that causes interference with the work of other trades shall be changed to correct condition.

1.07 COORDINATION DRAWINGS

A. Prior to the purchasing and fabrication of materials, each Subcontractor shall prepare Coordination Drawings for all floors/areas showing the size and location of his/her equipment and lines.

B. The Coordination Drawings shall be produced on AutoCAD Release 2016 minimum or compatible system. A disc and one (1) set of reproducibles (all-trade composite) shall be provided to the Architect/Engineer for review.

1.08 RECORD DRAWINGS

A. Purchase and maintain at the job site a complete and separate black line set of prints of the Contract Drawings on which accurately indicate daily progress by coloring materials and apparatus as installed. Schedules shall be modified to reflect data consistent with that of the installed equipment. Clearly show all changes to the work as a result of change orders, instructions issued by the Architect or conditions encountered in the field. Accurately indicate the location, size, type and elevation of new utilities and their relationship to existing utilities.

B. The marked up and colored in prints will be used as a guide for determining the progress of the work installed. They shall be inspected weekly and shall be corrected immediately if found inaccurate or incomplete. Requisitions for payment will not be approved until the Drawings are accurate and up-to-date.

C. At the completion of the work, submit one (1) set of marked up prints for review and comment. After review and comment, these marked up prints shall be used in the preparation of the Record Drawings. The Record Drawings shall consist of these prints (corrected) previously indicated, as well as two (2) CAD disks of the Final Coordination Drawings, corrected on the basis of the Architect/Engineer's final comments. Obtain and pay for one (1) set of reproducibles and CAD disks (AutoCAD Release 2016 minimum or compatible system) applicable to this Section. Make all modifications to these reproducibles as shown on the marked up prints. Remove all superseded data to show the completed installation. The Record Drawings may be made from the originals of the Contract Drawings. Arrange with the Architect to have these reproducibles made from the originals. Deliver the completed reproducible Record Drawings and CAD disks properly titled and dated to the Architect. These Record Drawings shall become the property of the Owner.

1.09 PERMITS, FEES, RULES AND REGULATIONS

A. Give the proper Authorities all requisite notices or information relating to the work under this 0Section. Obtain and pay for all fees, licenses, permits and certificates. Comply with the rules and regulations of all Local, State, and Federal Authorities having jurisdiction, Codes, Standards, recommended practices and manuals of the National Fire Protection Association, the Insurance Underwriter and the Public Utilities Companies serving the building.

1.10 PROTECTION OF WORK AND PROPERTY

A. Be responsible for the care and protection of all work included under this Section until it has been tested and accepted.

B. Protect all equipment and materials from damage from all causes including theft. All materials and equipment damaged or stolen shall be repaired or replaced with equal material or equipment.

C. Protect all equipment, outlets and openings with temporary plugs, caps and covers. Protect work and materials of other trades from damage that might be caused by work or workmen and make good damage thus caused.

D. When open flame or spark producing tools such as blow torches, welding equipment, etc., are required in the process of executing the work, the General Contractor will be notified not less than twenty-four (24) hours in advance of the time that the work is to begin and the location where the work is to be performed.

E. Provide, where necessary, fire protective covering and maintain a constant non-working fire watch where work is being performed and until it is completed.

F. All exposed piping in parking garages, warehouses and similar type occupancies shall be permanently protected against physical damage from any type of vehicle.

1.11 SUBMITTAL REQUIREMENTS

A. Submit for approval, within thirty (30) days after signing the Contract and prior to submission of any shop drawings, an itemized list of manufacturers, material, equipment and of Subcontractors proposed to be used under this Section.

B. After approval of the list, submit for review a minimum of eight (8) sets of detailed shop drawings. All shop drawings for equipment submitted for review shall include complete Specifications, including type of materials, operating pressures and temperatures, capacities, performance and power requirements to determine compliance with Contract Documents. All data submitted shall be complete for all equipment and shall apply only to this specific project.

C. Regardless of any information included in the shop drawing submitted for review, the requirements of the Drawings and Specifications shall not be superseded in any way by the shop drawing review.

D. Each submittal shall be reviewed, stamped and certified prior to submission to the Architect. Such certification shall be made by the Owner, or Corporate Officer of the Contractor, or by a person duly authorized by the Owner to sign binding agreements for the Contractor. The certification shall state that data and details contained on each shop drawing, layout drawing, catalog data and brochure has been reviewed by the Contractor and that it complies with the Contract Documents in all respects. Shop drawings, layout drawings, catalog data and brochures will not be reviewed and will be returned to the Contractor unchecked unless they are certified.

E. It is intended that the Contractor submit complete and accurate data at the first submission. If the shop drawing is returned marked “Resubmit”, or “Not Accepted”, only one (1) additional submission will be permitted.

F. Equipment shall be of proper size for its allotted space. Equipment shall be disassembled as required, without invalidating the manufacturer’s warranty, so that it can be installed through regular window, door and/or louver openings.

G. The shop drawings and manufacturer’s data shall be submitted in a timely manner sufficiently in advance to give ample time for checking, correcting, resubmitting and rechecking if necessary. No claim for delay will be granted for failure to comply with this requirement.

H. A minimum period of two (2) weeks, exclusive of transmittal time, will be required in the Engineer’s office each time shop drawings, layout drawings and catalog data and brochures are submitted or resubmitted for review. This time period shall be considered by the Contractor when scheduling his work.

1.12 MATERIAL AND EQUIPMENT STANDARDS

A. Where materials or equipment are specified by patent proprietary name or name of the manufacturer, such specification shall be deemed to be used for the purpose of establishing a standard for that particular item. No equipment or material shall be used unless previously approved by the Architect.

B. Substitutions may be offered for review provided the material, equipment or process offered for consideration is equal in every respect to that indicated or specified and only if the term "approved equal" appears. The request for each substitution must be accompanied by complete specifications together with drawings or samples to properly appraise the materials, equipment or process.

C. If a substitution of materials or equipment in whole or in part is made, the Contractor shall bear the cost of any changes necessitated by any other trade as a result of said substitution.

D. Manufacturer's directions shall be followed in the delivery, storage and installation of any equipment. Notify the Architect/Engineer, in writing, of any conflict between the Contract Drawings and the manufacturer's requirements and obtain a written response prior to proceeding with work. Should the Subcontractor fail to comply with this, he/she shall bear the costs of any corrections which may be required.

E. The Subcontractor shall furnish and install all equipment, accessories, connections and incidentals to complete the work under this Section.

F. All plumbing products submitted or utilized shall be Commonwealth of Massachusetts Board of State Examiners of Plumbers and Gas Fitters approved as well as the Reduction of Lead in Drinking Water Act.

1.13 GUARANTEE

A. Manufacturers shall provide their standard warranties for material and equipment furnished under this Section. Such warranties shall be in addition to and not in lieu of all liabilities which the manufacturer and Contractor may have by law or by provisions of the Contract Documents.

B. All materials, equipment and work furnished under this Section shall be guaranteed against all defects in materials and workmanship for a period of one (1) year commencing with the date of Substantial Completion. Any failure due to defective material, equipment or workmanship which may develop shall be corrected at no expense to the Owner, including all damage to areas, materials and other systems resulting from such failures.

C. Upon receipt of notice from the Owner of failure of any part of the systems during the guarantee period, the affected parts shall be replaced. Any equipment requiring excessive service shall be considered defective and shall be replaced.

1.14 CONTINUITY OF SERVICE AND SCHEDULING OF WORK

A. Continuity of all services shall be maintained in all areas which will be occupied during the construction period. When an interruption of service becomes necessary, such shall be made

only upon consent of the Owner and at a time outside normal working hours as he shall designate.

B. Refer to the overall scheduling of the work of the project. Schedule work to conform to this schedule and install work to not delay nor interfere with the progress of the project.

1.15 CERTIFICATES OF APPROVAL

A. Upon completion of all work, furnish in duplicate certificates of inspections from all inspectors and authorities having jurisdiction, notarized letters from the manufacturers stating that authorized factory engineers have inspected and tested the operation of their respective equipment and found same to be in satisfactory operating condition.

1.16 REMOVAL WORK

A. Particular care shall be taken to avoid creating hazards on the site or causing disruption of service.

B. All existing equipment to be removed shall be done in a neat and workmanlike manner. All existing equipment to be turned over to the Owner shall be presented to the Owner in good condition at a location designated by the Owner. All other equipment shall be removed from the premises.

C. Remove all abandoned piping and equipment not built into building construction. Where ceiling or walls are removed all abandoned piping shall be removed and ends of live services capped. Abandoned elements built into walls or located above existing inaccessible ceilings shall remain and ends capped and marked abandoned.

1.17 SUBSTANTIAL COMPLETION

A. When Subcontractor considers Work under this Section (or designated portion of Work) is substantially complete, submit written notice through the General Contractor with a list of items remaining to be completed or corrected.

B. Should Architect and/or his Engineer observe and find Work is not substantially complete, he will promptly notify Subcontractor through the General Contractor in writing, listing observed deficiencies.

C. Subcontractor shall remedy deficiencies and send a second written notice of substantial completion.

D. When Architect and/or his Engineer finds work is substantially complete he will prepare a Certificate of Substantial Completion in accordance with provisions of General Conditions.

1.18 FINAL COMPLETION

A. When Subcontractor considers Work under this Section is complete, submit through the General Contractor written certification that:

1. Contract documents have been reviewed.

2. Work has been inspected for compliance with Contract Documents.

3. Work has been completed in accordance with Contract Documents and deficiencies listed with Certificate of Substantial Completion have been corrected.

4. Equipment and systems have been tested, adjusted and balanced and are fully operational.

5. Operation of systems has been demonstrated to Owner's personnel.

6. Work is complete and ready for Architect's and/or his Engineer's final review.

B. Should Architect and/or his Engineer observe and find work incomplete, he will promptly suspend his review and notify Subcontractor in writing through the General Contractor.

C. Subcontractor shall complete his work, remedy deficiencies and send a second certification of final completion.

D. Architect and/or his Engineer shall, upon receipt of a second certification of completion, make a second review and shall notify the Subcontractor in writing through the General Contractor listing observed deficiencies.

E. When Architect and/or his Engineer finds work complete, he will consider close out submittals.

1.19 REOBSERVATION

A. Should status of completion of Work require additional services by Architect and/or his Engineer due to failure of Work to conform with Subcontractor's claims on initial Architect and/or Engineer's review for Substantial Completion or for Final Completion, Owner will deduct the amount of Architect and/or his Engineer's compensation for additional services from final payment to Subcontractor.

1.20 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

A. Give detailed instructions, prior to the completion of the work, to the responsible personnel designated by the Architect in the operation and maintenance of all work installed under this Section. A letter with two (2) copies containing the name of the person or persons to whom the instructions were given and the dates of the instruction period shall be submitted to the Architect at the completion of the project.

B. Prepare three (3) sets of manufacturer's catalogs, other similar data including the necessary photographic equipment cuts, wiring diagrams covering all mechanical equipment and devices furnished and installed under this Section. These manuals shall provide complete instructions for the proper operation and use of the equipment together with instructions for lubrication and periodic maintenance and for trouble shooting. Operating instructions shall be specific for each system and shall include copies of posted specific instructions. This manual shall contain only that information which specifically applies to this project, and all

unrelated material shall be deleted. During the instruction period this manual shall be used and explained. The material shall be bound in notebook form and indexed.

C. Provide name, address and telephone number of the manufacturer's representative and service company for each piece of equipment so that the source of replacement parts and service for each item of equipment can be readily obtainable.

1.21 ALLOWANCES

A. Inasmuch as this is a "Guaranteed Maximum Price" fast-track type project, the Associated Drawings issued with this Specification may be incomplete in some respects due to a lack of specific design criteria as may relate to architectural features; Owner furnished equipment, etc., or have a high likelihood for change.

1.22 ASBESTOS REMOVAL (Short Form Version)

A. Should this Subcontractor or any of its Sub-Subcontractors encounter any asbestos and/or asbestos related products or materials (the "asbestos materials") during the performance of its work, this Subcontractor shall stop work immediately and so inform the General Contractor and the Owner of the presence of asbestos.

1.23 EQUIPMENT CONNECTIONS

A. Make all final plumbing connections to all new as well as existing to be relocated equipment not furnished as part of this Section, such as but not limited to Kitchen Equipment, Medical Equipment, Laboratory Equipment or similar items requiring plumbing services. Provide all rough plumbing systems to these same items of equipment. Refer to the equipment shop drawings and manufacturers' requirements for final locations of connections prior to laying out or installing any work. Furnish and install all traps with cleanouts and heavy-duty brass loose key angle valve supply stop kits. Traps and angle valve kits shall include polished chrome-plated escutcheons. All supply stops shall have threaded or sweat solder inlet. Every faucet shall have a supply stop kit for each water supply. All exposed traps and supply stop kits shall be polished chrome-plated.

1.24 VIBRATION ISOLATION AND SEISMIC RESTRAINTS

A. Installation of Plumbing equipment, accessories and components shall be in accordance with the Seismic Requirements identified in the Massachusetts State Building Code, Ninth (9th) Edition. Refer to Part Two (2) of the Specifications for further information.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

A. Type: A

1. Type K hard drawn copper tubing with cast brass sweat fittings joined with approved silver solder.

B. Type: B

1. Type L hard drawn copper tubing with wrought copper sweat fittings joined with approved 95/5 lead free solder.

C. Type: C

1. Type L hard drawn copper tubing with Viega Pro-Press Mechanical Press Connect Fittings: Bronze, or copper shall conform to ASME B16.51, ICC LC 1002, IAPMO PS 117,NSF 61-G / NSF 372 - (Zero Lead Compliance). ProPress fittings ½-inch thru 2-inch for use with ASTM B88 copper tube type K, L, or M and ½-inch up to include 1-1/4-inch annealed copper tube. ProPress fittings shall have an EPDM sealing element and Smart Connect (SC) feature - guaranteed un-pressed fitting detection. 1-1/2-inch and 2-1/2-inch shall have a 420 stainless steel grip ring, PBT separator ring, EPDM sealing element and Smart Connect (SC) feature. System must be installed in conformance to manufacturer's instructions / specifications for approved applications and all installers trained by the manufacturer.

D. Type: D

1. No hub cast iron soil pipe and fittings joined with approved stainless steel mechanical couplings with neoprene gaskets. All Cast Iron Soil Pipe and Fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and NSF or receive prior approval of the Engineer

E. Type: E

1. Service weight bell and spigot cast iron soil pipe and fittings joined with neoprene resilient gaskets All Cast Iron Soil Pipe and Fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and NSF or receive prior approval of the Engineer

F. Type: F

1. Type DWV hard drawn seamless copper tubing with wrought copper drainage fittings joined with 95/5 lead free tin antimony solder.

G. Type: G

1. Schedule 40 galvanized steel pipe with Class 125 galvanized cast iron fittings joined with threaded connections.

H. Urinal branch and fixtures wastes shall be of extra heavy or service weight cast iron soil pipe and fittings with caulked joints, threaded cast iron pipe with cast iron drainage fittings, or iron size copper or brass pipe with cast brass drainage fittings. Resilient gaskets and no hub clamps with elastomeric sealing sleeves shall not be used on urinal wastes until an intersecting point of dilution with other fixtures in the drainage system is attained.

I. Pipe and fittings shall be in accordance with the following:

1. Cold Water Inside Buried Type A
2. Cold Water (2" and smaller) Type B/C
3. Hot Water Supply and Recirculation (2" and smaller) Type B/C
4. Sanitary, Waste and Vent Inside Buried Type E
5. Sanitary, Waste and Vent Within the Building Type D
6. Waste and Vent Smaller than 2 inches Type F
7. Ejector and Sump Pump Discharge
8. Pressure Portion Type G
9. Water Heater Relief Valve Discharge Type F
10. Water Heater Safe Pan Discharge Type F
11. Indirect Waste Piping smaller than 1-1/4 inch Type F

2.02 INSULATION

A. Type A: Owens Corning Fiberglas ASJ/SSL-II heavy density resin-bonded inorganic glass, all service jacket, kraft reinforced foil vapor retarder jacket with two factory-applied pressure sensitive adhesives for positive closure and vapor sealing. Turn all laps away from normal view. Circumferential joints shall be sealed with self-sealing butt strips. Valves and fittings shall be insulated with Zeston Hi-Lo temperature insulation of thickness equal to adjacent piping and covered with Zeston 2000 PVC fitting covers, U.L. 25/50 fire rated with approved vapor retarder mastic compatible with the PVC applied around the edges of the adjoining pipe insulation and on the fitting cover throat overlap seam. Secure with pressure sensitive PVC; Z tape along the circumferential edges. Extend tape over adjacent insulation with overlap on itself of at least 2 inches.

B. Type B: Owens Corning Fiberglas ASJ heavy duty resin bonded inorganic glass, all service jacket with longitudinal laps sealed with staples. Turn all laps away from normal view. Circumferential joints shall be sealed with self-sealing butt strips. Valves and fittings shall be insulated with Zeston Hi-Lo temperature insulation of thickness equal to adjacent piping and covered with Zeston 2000 PVC fitted covers, U.L. 25/50 fire rated, secured in place with tacking and finished with pressure sensitive PVC Z tape along the circumferential edges. Extend tape over adjacent insulation with overlap on itself of at least 2 inches. All tacks and staples shall be finished over with white finish.

C. Type C: Insulate all exposed waste, cold water, hot water and tempered water pipe, valves and fittings beneath handicapped lavatory and sink installations with Plumberex: Handy-Shield Maxx. Installed Insulators Protectors shall meet ADA 2010 Technical requirements sec. 4.19.4, ADAAG sec. 606.5, ICC/ANSI A117.1 sec. 606.6, or GSA & DOD's ABA 606.5. Insulation material shall comply with IBC (International Building Code) Flame and

Smoke Testing Standard ASTM E 84-07/ UL 723 Class A. Insulator Protectors shall be listed and meet UPC/IAPMO Standard PS 94-2008. Insulation material shall be soft 1/8", non laminated flexible PVC with U/V inhibited antimicrobial, antifungal properties, with high gloss color finish matching fixture. Adhesives, sewing threads, and two ply laminated materials are not allowed. ASTM C177 tested "R" value of 0.504 for Thermal resistance and ASTM C518 "K" value of 0.358, Density-21.61 PCF for Thermal Conductivity. One piece fusion molded universal design for changeable P-trap configurations. Exterior surfaces shall be smooth, nonabsorbent with no finger recessed indentations to eliminate dirt and grime and for easy cleaning. Weep hole shall be included for sanitary condensation drainage and ventilation at the bottom of J-bend. Insulator Supply riser shall be min.15" in length and flexible for continuous covering of braided flexible water supplies. Dual fastening system consisting of fusion bonded Velcro fastener strips for full slit enclosure and tamper resistant, non-abrasive snap-locking fasteners. No cable tie fasteners allowed.

D. Type D: Field-Applied Jackets:

1. PVC Plastic: Zeston® 2000 Series. One piece, molded type fitting covers and jacketing material, gloss white.

   a. Connections: Tacks, pressure sensitive, color matching, vinyl tape.

2. Aluminum Jacket: 0.016" (0.41 mm) thick sheet, (smooth/ embossed) finish, with longitudinal slip joints and 2" (51 mm) laps, die-shaped fitting covers with factory-attached protective liner.

3. Stainless Steel Jacket: Type 304 stainless steel, 0.10" (2.54 mm), (smooth/ corrugated) finish.

E. Insulation shall be in accordance with the following schedule:

System	Insulation Thickness	Type
Cold Water	1/2"	A
Hot Water (1-1/4" & smaller)	1"	B
Hot Water (1-1/2" & larger)	1-1/2"	B
Exposed Cold Water, Hot Water and Waste Beneath Handicapped Lavatories and Sinks	N/A	C
Field Applied Jacket	NA	D

2.03 HANGERS AND SUPPORTS

A. Pipe hangers, pipe anchors, auxiliary steel, wood blocking and fixture supports shall be furnished and set by this Contractor, and he shall be responsible for their proper and

permanent location. This Contractor shall be responsible for all core drilling. All buried hubless cast iron shall be supported.

B. All piping shall be rigidly supported from the building structure by means of approved hangers and supports. The hanging and support of all piping system shall conform to the ANSI/MSS-SP 58 AND MSS-SP 69 latest edition. This Contractor shall furnish and install all required auxiliary steel required for hanging of piping.

C. All horizontal piping shall be hung with approved adjustable malleable iron pipe hangers. Cast iron soil pipe shall be supported at five (5) foot intervals except where ten (10) foot lengths of piping are used, then ten (10) foot intervals are acceptable. Hangers shall be provided at each joint and at each horizontal branch connection. Hangers shall be adequate to maintain alignment, prevent sagging and shall be placed on or immediately adjacent to the coupling. Horizontal piping shall be braced against horizontal movement with sway bracing. Supports shall be placed directly beneath horizontal fittings that connect to the stack. Copper tubing 1-1/2 inch and larger shall be supported at ten (10) foot intervals. Copper tubing 1-1/4 inch and smaller shall be supported at six (6) foot intervals. Steel piping, 1/2 inch and smaller shall be supported at six (6) foot intervals. Steel piping 3/4 inch and 1 inch in size shall be supported at eight (8) foot intervals. Steel piping 1-1/4 inch and larger shall be supported at ten (10) foot intervals. Plastic piping 1-1/2 inch and smaller shall be supported at 4-1/2 foot intervals. Plastic piping 2 inch and larger be supported at six (6) foot intervals for piping three inch and larger. Plastic piping shall be supported by the use of a continuous channel

D. Vertical cast iron piping shall be supported at base, at each story height and at ten (10) foot intervals. Vertical steel piping and copper tubing shall be supported at each story height and at not more than ten (10) foot intervals. Vertical plastic piping shall be supported at each floor.

E. Hangers for piping sizes four (4) inches and smaller shall be Carpenter & Paterson, No. 1A band type, Grinnell Company, Calco Steel Products Company or equal, black steel with hanger rods with machine threads. Hangers for piping larger than four (4) inches shall be the adjustable clevis hanger type, malleable iron with extension rod. Chain, strap, perforated bar or wire hangers will not be approved. Approved gang hangers may be used in lieu of separate hangers on pipes running parallel to each other and close together. Where used for uninsulated copper tubing, all hangers shall be copper plated and chrome plated for chrome plated piping. Insulation shields shall be provided on all horizontal insulated piping at each hanger or support location. Insulation shields shall be galvanized steel, 180 degrees arc and centered on the hanger or support. On diameters 4 inches and smaller, shield shall be 12-inch long, 18 gauge steel. On diameters 5 inches and 6 inches, shield shall be 18-inch long, 16 gauge steel. On diameters 8 inches and 10 inches, shield shall be 24-inch long, 14 gauge steel. On diameters greater than 10 inches, shield shall be 24-inch long, 12 gauge steel. Structure attachments shall be as manufactured by Carpenter & Patterson and shall be suitable to carry the weight. Hanger assemblies in locations exposed to the weather shall utilize galvanized steel components. Example of such a location would be, but is not limited to, a parking garage that is open to the weather.

F. All fixtures and equipment shall be supported and fastened in a satisfactory manner and in accordance with fixture manufacturer's recommendations.

G. Where chair carriers are required, they shall be completely concealed in the building construction and shall rigidly support the fixture from the floor. Chair carrier shall support fixtures in such a manner that no part of the fixture will be supported by the wall or partition. Chair carriers shall be furnished complete with necessary bolts, nuts and washers as well as connecting nipples of the proper length with gaskets for the fixture connection. Provide auxiliary support assembly in wide chase situations whenever the water closet coupling is of a length that the carrier manufacturer recommends the auxiliary foot support directly behind the wall. All available or optional anchor foot assemblies shall be utilized. Carriers must fit in available space and shall be of the special narrow type or compact style where necessary. Chair carriers for water closets and urinals shall include flushometer supply pipe support. Flushometer supply pipe shall always be provided with a concealed support regardless of if the design includes a carrier or not.

H. Wherever wood blocking is required to insure adequate support of fixtures and related piping, it shall be provided by this Contractor and it shall be fire treated.

I. All inserts in new concrete construction shall be capable of developing the full strength of the rod or bolt used in them and shall be either continuous insert type or malleable iron concrete inserts for rod sizes 3/8 inch to 7/8 inch. Continuous inserts shall have anchors every 4 inches and shall extend 1-1/2 inches above the back of the insert and shall hook to provide anchor. All inserts shall be tied to the reinforcing steel rods with wire and properly sized reinforcing rods shall be inserted through the special holes, hooks or brackets provided in or on the inserts to securely anchor insert to the structure.

J. Pipe alignment guides shall be split-sleeve type as manufactured by Broat Manufacturing, Inc. and shall be suitable for copper tubing.

2.04 SLEEVES, ESCUTCHEONS AND FIRESTOPPING

A. Sleeves shall be furnished and set by this Contractor and he shall be responsible for their proper and permanent location. This Contractor shall be responsible for all core drilling. Core openings shall have link-seal fire-rated penetration closures.

B. This Contractor shall provide steel sleeves at all points where pipes and all other work under his charge pass through masonry, concrete or wood. Sleeves shall have flanges or wings at mind-points to prevent sleeve from slipping through the floor or wall. Pipe sleeves shall be sufficient diameter to provide approximately 1/4 inch annular clearance around the pipe or the insulation on insulated systems. Sleeves through walls shall end flush with the surface of the walls. Sleeves in floors shall extend two inches above the floor and after installation of piping shall be packed, firestopped and made watertight. Sleeves in exterior walls shall have waterstop plates, shall end flush with the surface of the walls, shall have link-seal penetration closures and shall be of a diameter that is compatible with the Link Seal System.

C. Seal the sleeve penetrations with firestopping and smoke stopping systems as manufactured by Dow Corning, Bio-Shield, Rectorseal Metacaulk, 3M, Hilti, Fyre Putty or equal. Where pipes penetrate fire rated construction, the openings shall be packed with the material and system that shall maintain the integrity of the fire rating as detailed in the UL Fire Resistance Directory.

D. Pipe Sleeves shall be according to the following:

1. Sleeves on pipes passing through masonry or concrete construction shall be scheduled 40 galvanized steel pipe.

2. Sleeves on pipes passing through wood or drywall partitions shall be 16 gauge galvanized steel.

E. Whenever new penetrations to a previously poured slab are required for the installation of floor drains, shower drains, mop receptors, flush floor cleanouts or similar items of plumbing, these penetrations shall be totally sealed with a fire and water stop sealant. Sealant shall be Dow Corning fire stop sealant, Catalog No. 2000. Hourly fire rating in hours must be meet the requirements of the slab being penetrated.

F. Provide chrome plated brass escutcheons with set screws for exposed piping in all areas. In mechanical rooms use plain brass or cast iron escutcheons suitable for painting. All escutcheons shall be sized to fit the bare pipe or insulation in a snug and neat manner. They shall be of sufficient size to cover sleeves openings for the pipes and of sufficient depth to cover sleeves projecting above floors.

2.05 CLEANOUTS

A. All cleanouts shall be the product of one manufacturer.

B. Type A:

1. Zurn Series ZN-1400-KC-BP coated cast iron floor cleanout, internal tapered thread bronze plug, clamp and collar with adjustable nickel bronze top and bronze plug.

C. Type B:

1. Zurn Series ZN-1400-KC-CM coated cast iron floor cleanout, internal tapered thread bronze plug, clamp and collar, with adjustable nickel bronze top and carpet marker.

D. Type C:

1. Zurn Series ZN-1400-KC-X coated cast iron floor cleanout, internal tapered thread bronze plug, clamp and collar with adjustable nickel bronze top recessed for tile.

E. Type D:

1. Zurn Series ZN-1460-8 round stainless steel wall access cover, center screw and recessed bronze taper thread plug.

F. Type E:

1. Zurn Z-1470 recessed bronze taper thread plug for use in conjunction with standard pipe fittings.

G. Type F:

1. Zurn Z-1470 recessed bronze taper thread plug for use in conjunction with standard pipe fittings.

H. Cleanouts shall be in accordance with the following:

1. Sanitary, Waste and Storm Systems Buried Type A

2. Sanitary, Waste and Storm Systems Buried Carpeted Floors Type B

3. Sanitary, Waste and Storm Systems Buried Tiled Floors Type C

4. Sanitary, Waste and Storm Systems in Walls Type D

5. Sanitary, Waste and Storm Systems at Base of Stacks Type E

6. Sanitary, Waste and Storm Systems at Changes of Direction Type F

2.06 VALVES

A. All shut-off valves on cold water, hot water, and hot water recirculation piping from 1/2 inch up to and including 4 inch shall be Apollo Series 77FLFF-200, solder end, full port, forged lead free brass body, chrome plated bronze ball, 600 psi WOG, full port ball valve.

B. All shut off valves on cold water, hot water and hot water recirculation larger than 4-inch shall be Apollo 610F-LF, flanged ends, iron body bronze mounted, solid wedge, inside screw, non-rising stem, 200 psi WOG.

C. All check valves on cold water, hot water and hot water recirculation piping three inches and less in size shall be Apollo 161S-LF, solder end, bronze body swing check, bronze disc, 200 psi WOG.

D. All drain valves shall be 1/2 inch Apollo Model 70LF-100-HC with Apollo 38-300 hose connection vacuum breaker, cap with chain of length as required.

E. Thermomegatech Circuit Solver.

F. All ball valves for installation in insulated piping shall have valve extensions to suit installation thickness.

G. Gate valves on sewage and drainage ejector discharge piping shall be iron body, bronze mounted, solid wedge, outside screw and yoke, rising spindle, flanged ends, 200 psi, Apollo 611F. Check valves on sewage and drainage ejector discharge piping shall be iron body, flanged ends, bronze disc with lever and weight, Apollo 910FLW.

2.07 FLOOR DRAINS

A. All floor drains shall be the product of one manufacturer.

B. Refer to schedule on Construction Documents for floor drain information.

2.08 CIRCULATING PUMPS

A. Pumps shall be all bronze, centrifugal type, close coupled, with side suction as manufactured by Bell and Gossett Company, Taco Heaters, Incorporated, Thrush or approved equal. Pump shall be in line type with valved bypass. Motor shall be single phase, 60 hertz AC.

B. Pump shall be provided with a manual motor starting switch. Pump operation shall be controlled by an immersion type aquastat set to start pump and stop pump at selected settings. This Contractor shall provide all control wiring.

C. The following schedule shall be utilized in the Aquastat Settings.

CIRCULATING PUMP AQUASTAT SETTINGS				
Aquastat Settings	System HW Temp	Delta T Sizing Circ Pump	Circ Pump Start	Circ Pump Stop
A	120 degrees F	10 degrees F	105 degrees F	110 degrees F

2.09 SEWAGE EJECTORS

A. FURNISH WHERE SHOWN ON PLANS ONE DUPLEX SET OF WEIL Pump Co. 3” submersible SLICER pumps with 30’ POWER CABLES

B. Pumps shall be WEIL Series 2500 Model 2533 submersible SLICER PUMPS. Each pump shall be rated to provide 100 GPM @ 20’ TDH. Pumps to have 300 series stainless steel shafts, cast iron impellers, STAINLESS STEEL SLICING BLADES and 25’ POWER CABLES

C. Pump motors shall be, submersible, 2hp 208 Volt 3 phase, 60 HZ, and 1750 RPM.

D. Motor(s) shall be housed in watertight cast iron motor shell with extended cooling fins. Oil filled motors will not be considered equal. Motor(s) shall have Class ‘F’ insulation and permanently lubricated double seal ball bearings. Motor(s) using sleeve type bearing will not be considered equal. Mating surfaces between the motor and bell, motor shell and seal housing shall be sealed by means of ‘O’ rings. The motor shaft shall be Series 300 stainless steel with keyway for positive positioning of the impeller. Carbon steel and 400 series stainless steel shafts are not considered equal.

E. Impellers shall be cast iron multi-vane, semi-open type and accurately machined to the proper diameter. Impellers are to be trimmed to suit job conditions and then dynamically balanced.

F. 4- Mechanical suspended type float switches suspended from cover, each with 30' cables

G. (ALL FLOAT AND POWER WIRING TO BE DONE BY THE SITE LICENSED EC)

H. 1- 8167 DUPLEX NEMA 4 DDDF CONTROL PANEL, UL Listed Label: (PANELS USING PRINTED CIRCUIT BOARDS WILL NOT BE CONSIDERED EQUAL)

1. Through the door disconnect switch
2. 2- Magnetic starters with 3 coil OL protection
3. 2- Motor circuit protectors
4. 1- Automatic alternator
5. 2- H.O.A selector switches
6. 2- Pump running lights
7. 1- Alarm horn w/ silencer
8. 1- Set of isolated contacts for remote
9. 1- Padlocking Hasp (Padlock NOT Included)
10. 1- Control circuit transformer
11. 1-Control Terminal Board Numbered & Wired

I. Basin/Cover

1. 1- 48" X 60" (see plans) Deep fiberglass basin with inlet and anchor flange 6" from the top as required.
2. 1- 53" Round steel gas tight cover with all necessary openings.
3. Each pump to have the Weil 2613-3 duplex removal system.
4. See detail and schedules on drawings for further information prior to order.

2.10 WATER HEATERS

A. Refer to construction documents for water heater schedule.

2.11 ACCESS PANELS

A. Furnish access panels for access to all concealed parts of the plumbing systems that require accessibility for the proper operation and maintenance of the system.

B. Size shall be sufficient for the purpose, but no less than 12 inches by 18 inches. Particular attention shall be exercised in the selection of doors for masonry walls in order that frame sizes used will match the courses of brick or block.

C. Access doors shall be prime coated of rust inhibitive paint, continuous hinge and manufactured by Inland Steel Products Company "Milcor", Miami-Carey or Walsh-Hannon- Gladwin, Incorporated "Way Loctor". Type shall be based upon "Milcor" as follows:

1. Suspended Drywall Ceilings: Style ATR with 16 gauge frame, 18 gauge panel and flush screwdriver operated cam locks.

2. Plastered Walls and Ceilings: Style K with 16 gauge frame, 14 gauge panel and flush screwdriver operated cam locks.

3. Masonry Non-Rated Walls: Style M with 16 gauge frame, 14 gauge panel and flush screwdriver operated cam locks.

4. Fire Rated Walls and Ceilings: Style UFR fire rated with UL 1-1/2 hour "B" rating, 16 gauge frame, 20 gauge sandwich type insulated panel, self-latching lock having interior release mechanism, and key operated cylinder lock keyed as required to suit requirements of the Architect.

5. Non-rated Drywall Walls: Style DW with 16 gauge frame, 14 gauge panel, and screwdriver operated cam locks.

D. Point out to the Ceiling Subcontractor exactly which tile units are to be marked with a colored button to indicate equipment above.

2.12 PLUMBING FIXTURES

A. See schedule on construction documents for further information

2.13 PIPE IDENTIFICATION AND VALVE TAGS

A. All piping, except that piping which is within inaccessible chases, shall be identified with semi-rigid plastic identification markers equal to Seton Setmark pipe markers. Direction of flow arrows are to be included on each marker. Each marker background shall be appropriately color coded with a clearly printed legend to identify the contents of the pipe in conformance with the "Scheme for the Identification of Piping Systems" (ANSI 13.1-1981). Setmark snap-around markers shall be used for overall diameters up to six inches and strap-around markers shall be used above six inch overall diameters. Markers shall be located

adjacent to each valve, at each branch, at each cap for future, at each riser take off, at each pipe passage through wall, at each pipe passage through floors, at each pipe passage to underground and on vertical and horizontal piping at 20 foot intervals maximum. All non-potable water lines and outlets shall be identified as "Water Subject to Questionable Safety" in accordance with the requirements of the Massachusetts Uniform State Plumbing Code. Piping supplying natural gas at a pressure greater than 1/2 psig or 14 inch water column shall be color coded yellow and labeled a minimum of every ten feet, at all changes in direction, on each side of a penetration and at each valve. The labels shall be black lettering, capable of being read from a normal line of vision that indicates the type of gas and the pressure contained within.

B. Markers are to be applied to all piping, regardless of under jacket colors per the following schedule:

Service	Legend	Background Color
Cold Water	Domestic Cold Water	Green
Hot Water	Domestic Hot Water	Yellow
Hot Water Return	Domestic Hot Water Return	Yellow
Non-Potable Water	Non-potable	Yellow
Sanitary Waste	Sanitary Sewer	Green
Sanitary Vent	Sanitary Vent	Green

C. All valves shall be designated by distinguishing numbers and letters carefully coordinated with a valve chart. Valve tags shall be 19 gauge polished brass, 1-1/2 inch diameter with stamped black filled letters similar to Seton S type 250-BL or approved equal. Lettering shall be 1/4 inch high for type service and 1/2 inch for valve number. Tag shall be attached to valves with approved brass "S" hooks, or brass jack chain. Whenever a valve is above a hung ceiling, the valve tag shall be located immediately above the hung ceiling.

D. Furnish a minimum of two typed valve lists to be framed under glass or Plexiglass. Each chart shall be enclosed in an approved .015 inch thick plastic closure for permanent protection. Valve numbers shall correspond to those indicated on the Record Drawings and on the printed valve lists. The printed list shall include the valve number, location and purpose of each valve. It shall state other necessary information such as the required opening or closing of another valve when one valve is to be opened or closed. Printed framed valve lists shall be displayed in each Mechanical Room or in a location designated by the Owner.

E. Equipment nameplates shall be 3/4 inch by 2-1/2 inch long .02 inch aluminum with a black enamel background with engraved natural aluminum letters similar to Seton Style 2065-20. Nameplate shall have pressure sensitive taped backing.

F. Provide a brass wall plaque, minimum .020 inch thickness, secured to the exterior wall just above the grade line for all buried service entrances or exits. Samples of such are: Water Service Below; Gas Service Below; Sanitary Sewer Below; Storm Sewer Below, Irrigation Water Below; etc.

2.14 DISINFECTION OF WATER SYSTEMS

A. All water systems shall be disinfected in accordance with Local Public Health and Plumbing Code Requirements.

B. Water piping systems shall be thoroughly disinfected with a solution containing no less than 50 parts per million of available chlorine. Chlorinating materials shall be either liquid chlorine or sodium hypochlorite solution, shall be introduced into the system and drawn to all points in the system. Disinfection solution shall be allowed to remain in system for 30 minutes, during this time, valves and faucets shall be opened and closed several times. After disinfection, solution shall be flushed from the system with clear water until residual chlorine content is no greater than 0.2 parts per million.

1. Bypass all building filters.

2. Perform chlorination prior to heating the domestic hot water system. Run circulation pumps on the domestic HW system.

3. Provide advance notice to all trades prior to procedure. Post warning signs throughout the job site.

4. Collect samples randomly and at end user points.

C. Work shall be supervised by Owner and performed by approved chemical testing laboratory and results sent to the Architect or Architect's representative for verification.

D. Testing laboratory shall submit a summary of test procedure for approval prior to any work performed. Work shall be in accordance with Owner's requirements. Subcontractor shall provide valves required to disinfect water supply system in part as required by phasing of construction and to provide isolating valves and draw-off valves for proper containment, phasing and flushing.

2.15 TESTS AND APPROVALS

A. Pipe lines shall be blown or flushed clean, before piping tests are applied. All plumbing work shall be tested as herein specified. No portion shall be covered, concealed, used or made inaccessible to testing, inspection, repair, correction or replacement until tests thereof have been satisfactorily completed in the presence of the Architect's Authorized Representatives. The Plumbing Subcontractor must accommodate his testing operations to the progress of the project as a whole. Correct all defects appearing under test and repeat the tests until all parts of the work have withstood them successfully.

B. Furnish all labor, material and services for testing, including testing plugs, pumps and compressors; he shall make and remove all temporary piping connections required for the tests and shall dispose of test water and all wastes after tests. Leave all work in good order, ready for full use.

C. Tests on all plumbing systems shall be made in accordance with the requirements of the Local Plumbing Code and the codes, standards, recommended practices and manuals of the National Fire Protection Association.

D. Documentation of tests to be provided including name and signature of person performing test, date, and description of test including acceptance criteria and actual results. Sample test form to be provided to owner and commissioning agent for approval prior to beginning testing.

E. Commissioning agent to be notified of planned testing at least 48 hours in advance to provide the opportunity to observe.

1. Testing Summary

System	Test Medium	Test Pressure	Test Duration
Gravity Waste and Vent (all systems)	Water	10 feet	30 minutes
Water (all systems)	Water	150 psig	1 hour

2. Defective Work: If inspection or tests show defects, such defective work or material shall be replaced and inspection and tests shall be repeated. Repairs to piping shall be made with new material. No caulking of screwed joints or holes shall be acceptable.

3. Additional Tests

a. Provide additional tests such as smoke pressure tests as required by regulations or as directed by authorities making the inspection.

b. Provide for any repeated test as directed by the Architect, to make all systems tight as required.

c. Visual inspections of joints and valves shall be made as directed by the Architect.

2.16 WATER HAMMER ARRESTERS

A. Maintenance free water hammer arresters shall be furnished and installed at all locations in the water systems where quick acting valves are installed as well as wherever water hammer may occur. Examples of such locations are as follows:

1. Self-closing and metering faucets.

2. Prior to all in-line solenoid valves.

3. Dishwashing Machines.

4. Single handle faucets.

5. Quarter turn faucets and valves.

B. Water hammer arresters shall be as manufactured by Josam Manufacturing Company, Jay R. Smith Manufacturing Company or Zurn Systems. Arresters shall be installed at each and

every multiple of fixtures or items as listed above, water hammer arresters may serve groups of fixtures. Sizing and placement shall be in accordance with PDI Standard PDI-WH-201 and the manufacturer's recommendations. Provide access panels.

C. Water hammer arresters shall be as follows:

Type	Fixture Unit Rating	Model	Option Model
1. SA "A"	1-11	Josam 75001	Jay R. Smith 5005
2. SA "B"	12-32	Josam 75002	Jay R. Smith 5010
3. SA "C"	33-60	Josam 75003	Jay R. Smith 5020
4. SA "D"	61-113	Josam 75004	Jay R. Smith 5030
5. SA "E"	114-154	Josam 75005	Jay R. Smith 5040
6. SA "F"	155-330	Josam 75006	Jay R. Smith 5050

2.17 PRESSURE GAUGES

A. Pressure gauges shall have brass movement, aluminum case, double strength clear glass window with black embossed figures and graduations on a white dial face, with 1 percent accuracy of scale range. Gauges shall be manufactured by Trerice Company, Taylor Instrument or Marshalltown Manufacturing.

B. Gauges shall be furnished with snubbers and needle valve shut off valves.

C. Gauges shall be 4-1/2 inch diameter furnished with ranges that will locate the intended pressure at the point of application approximately midpoint on the range scale. Gauges for natural gas, vacuum and similar low pressure systems shall be gauges specifically designed for low pressure applications.

2.18 THERMOMETERS

A. Thermometers shall be adjustable angle design of the separable well type and shall have a 9 inch cast aluminum case. The scale shall be white with black figures and graduations embossed on the scale. The column shall be filled with blue organic fill. Thermometers shall be manufactured by Trerice Company, Taylor Instrument or Marshalltown Manufacturing.

B. Thermometers shall be furnished complete with all necessary sockets, wells, connectors and accessories required for installation suitable for the service in which installed. Extension necks shall be furnished for insulated piping.

C. Thermometers shall be furnished with the temperature ranges of Zero to 100 degrees F for cold water and chilled water and of 30 to 240 degrees F for hot water systems.

2.19 THERMAL EXPANSION TANKS

A. Provide precharged thermal expansion absorbers designed and constructed per ASME Code, Section VIII. Expansion absorbers shall have precharged air chamber, steel outer shell, rigid polypropylene liner, heavy duty butyl diaphragm and stainless steel connection. Expansion

tanks 5 gallons or smaller of total volume may be installed in line and supported from overhead. Tanks greater than 5 gallons of total volume shall be floor mounted on a 4 inch housekeeping pad.

B. Expansion tank sizes shall be as manufactured by Elbi of America, Inc. and shall be in accordance with the following:

Expansion Tank No.	Model No.	Total Volume in Gallons	Connection Size
ET-1	DTS-8	2	1”

PART 3 - EXECUTION

3.01 POTABLE WATER SYSTEMS

A. All copper tubing shall be cut accurately to measurements obtained at the site and shall be installed without springing or forcing.

B. Branch lines from service or main lines may be taken off the top or bottom of main using such crossover fittings as may be required by structural or installation conditions. All service pipes, fittings and valves shall be kept at sufficient distance from other work to permit not less than 1/2 inch from finished coverings and such other work and not less than 1/2 inch between finished coverings on the different services.

C. All piping shall be supported from the building structure with pipe hangers. Every water supply riser from the shower valve to the shower head, whether or not exposed, shall be securely attached to the structure. In general, all lines shall be installed concealed above ceilings in finished spaces where they may occur.

D. All copper tubing shall be cut true with cutters; the ends shall be reamed out to the full inside diameter of the pipe. Cap all open ends to prevent the entrance of debris.

E. Provide water hammer arresters. Provide expansion loops. Balance hot water recirculating systems.

F. Provide valves on every branch, to group of fixtures and wherever indicated on the Drawings.

G. Pipes shall be run parallel and graded evenly to draining points. Provide a hose end drain valve, hose connection vacuum breaker with cap and chain at each low point in piping so that all parts of the systems can be drawn off.

3.02 SANITARY SYSTEMS

A. Soil, waste and vent piping inside the building shall be run as indicated on the Drawings, properly secured to the building structure with iron hangers. Extend to roof all lines of soil, waste and vent piping in stacks with all branches and fittings required and extension through roofs as required by the Local Plumbing Code. Where an end circuit vent pipe from any fixture or line of fixtures is connected to a vent line serving other fixtures, the connection

shall be at least 3 feet or sufficiently above the floor on which the fixtures are located to prevent the use of the vent line as a waste.

B. All changes in pipe size and direction on soil and waste lines shall be made with Y's and cleanouts, reducing fittings or recessed reducers. Y's and 45° fittings, or 45° combination fittings shall be used wherever possible. Use long sweep bends at the bottom of stacks.

C. All fixtures and drains on the sanitary drainage system shall be separately trapped and each trap shall be vented. Where trap seals are subject to evaporation, they shall be provided with a drip seal and with a water supply fed from an approved automatic priming device.

D. Sanitary long sweep bends and Y's shall be used for connections to branch lines for fixtures and T.Y's on vertical runs of pipe only. Long turn fittings shall be used wherever conditions permit. Short radius fittings may be installed where in conformity with the Plumbing Code. Furnish and install cleanouts at the bottom of all soil, and waste stacks, at every change in direction on soil, and waste piping. An end or dandy cleanout fitting the same size as the drain which it connects shall be installed under all kitchen, kitchenette, coffee room or similar usage sinks. An approved two-piece trap which can be disassembled to clean this drain may be used in lieu of the cleanout. Plug all temporary open ends to prevent the entrance of debris.

E. When installing a fitting or making repairs to an existing soil stack, waste stack, vent stack or drain, said fittings or repairs shall be made of the same material as the existing stack or drain using an approved joining method.

F. All individuals making pipe tie-ins to hospital waste and vent, mortuary waste and vents, laboratory waste and vents, dental waste and vents shall have the surface of the body and clothing protected by disposable or washable gowns similar or equal to gowns, gloves and face masks worn by surgical staff.

3.03 INSULATION

A. All pipe covering and insulation shall be carefully applied by mechanics skilled in the trade.

B. Pipe coverings and insulation shall be installed on all piping, valves and fittings. Piping, valves and fittings designated to be chrome-plated shall not be insulated except hot water, cold water and waste beneath handicapped lavatories and sinks, which shall be insulated.

C. All systems shall be tested and approved prior to installing pipe covering and insulation.

D. Staples are not to be used on any insulation system utilizing a vapor barrier jacket.

E. All pipe covering and insulation shall pass through all walls, ceiling and floor continuously. The only area where the insulation shall not pass continuously shall be at riser clamps. Hangers shall be installed with insulation shields on the outside of the insulation.

F. All references to hot water systems shall include hot water and tempered water at all temperatures including the supply and the recirculation.

G. Insulation requirements apply equally to non-potable water systems as they do potable water systems.

3.04 CLEANOUTS

A. All concealed cleanouts shall be set flush with walls or floors. Finish shall be protected during construction with proper covering. Flush floor cleanouts shall be coordinated so as to not be located beneath any partitions, casework nor beneath any non-portable equipment. Cleanouts shall be iron body with heavy brass plug and raised nut, same size as pipe for piping up to four (4) inches and not less than four (4) inches in size for piping larger than four (4) inches and closed gas-tight. Floor cleanouts in carpeted areas shall have carpet cleanout markers. Floor cleanouts shall not be located beneath partitions, casework, non-portable equipment or similar installation conditions.

3.05 VALVES

A. All valves furnished and installed under this Section shall be located in a manner to allow proper access for service and repair.

B. In no case shall valve stem and handle on a gate or globe valve be installed below the center line of the pipe it serves. Whenever a valve is provided for a future connection this valve shall be left in the closed position.

C. Valve handle extensions shall be provided for all valves installed on insulated piping. Insulation shall not be cut back to allow for valve operation.

3.06 ACCESS PANELS

A. Furnish and deliver access panels for access to all concealed parts of the plumbing systems that require accessibility for the proper operation and maintenance of the system. Access panels shall be installed by the appropriate trades.

3.07 PLUMBING FIXTURES

A. All plumbing fixtures, except as otherwise noted, shall be furnished and installed by this Contractor; he shall be responsible for correctly setting these fixtures as shown on Architect's Plans and interior elevations. All wall penetrations shall have polished chrome-plated escutcheons.

B. Fixtures designated for barrier free use shall be mounted in accordance with the Americans with Disabilities Act (ADA) as well as State and Local Codes as applicable, or whichever is stricter if there is a conflict. Water closet flush valve lever shall be mounted on the wide side of the toilet areas.

C. All shower/tub controls shall be adjusted by the installing plumber prior to the final inspection. Controls shall be set to deliver water at a maximum temperature of 110°F to 112°F.

D. All lavatory controls, where applicable, shall be adjusted by the installing plumber prior to the final inspection. Controls shall be set to deliver water at a maximum temperature of 110 degrees F.

3.08 VENTS THROUGH ROOF

A. All vents extending through the roof which serve the sanitary and waste systems shall extend no less than 18" and no more than 24" above the roof. Where roofs are used for any purpose other than weather protection such as gardens, sun decks, parking decks or similar purposes, the vent shall extend at least 8 feet above the roof and be increased one pipe size and this change in pipe size shall be made at least one foot below the roof. Offset all vents requiring same in order to avoid interference with HVAC units, to facilitate flashing conditions as well as maintain minimum required distance from all natural and mechanical fresh air inlets.

B. All gas vents shall run through the roof and shall extend above the roof and shall be provided with 3/4" by 1" increaser when required, pipe nipple and Fisher Controls Model No. Y602-17 umbrella type, weather proof bug vent. Off-set all vents to avoid interference with rooftop equipment, to facilitate flashing as well as maintain minimum required distance from all natural and mechanical fresh air inlets.

C. No vent terminal shall be located directly beneath any door, window, or other ventilating opening of the building or of an adjacent building, nor shall any vent terminal be within 10 feet horizontally of such an opening unless it is at least 2 feet above the top of such opening.

D. Vent terminals shall be located at least 25 feet horizontally from all fresh air intakes.

E. All vents through sloping roofs shall be provided with a pipe support on the vertical pipe just prior to the roof penetration. This support shall be located between the exterior vent terminal and the first joint or fitting within the building.

3.09 ELECTRICAL ROOMS

A. Piping shall not be installed in or through Electrical Rooms, Electrical Closets, Transformer Rooms, Telephone Rooms or Elevator Machine Rooms unless the piping is intended to serve these rooms. No piping shall be installed over electrical panels.

DIVISION 23

SECTION 23 00 00

HEATING, VENTILATION & AIR CONDITIONING

PART 1 GENERAL

1.01 GENERAL PROVISIONS

A. Examine all Drawings and all Sections of the Specifications for requirements therein affecting the work and this Section. The exact scope of work cannot be determined without a thorough review of all specification sections and other contract documents.

1.02 RELATED DOCUMENTS

A. Division 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS and applicable parts of Division 01 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

B. Include GENERAL CONDITIONS, SUPPLEMENTARY GERNERAL CONDITIONS and applicable parts of Division 01 as part of this Section.

C. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under Contract.

D. When open-flame or spark producing tools such as blower torches, welding equipment, etc., are required in the process of executing the work, the General Contractor shall be notified not less than 24 hours in advance of the time that the work is to begin and the location where the work is to be performed. Provide, where necessary, fire protective covering and maintain a constant non-working fire watch where work is being performed and until completed.

E. The following definitions apply to the Drawings and Specifications

1. Furnish: The term “furnish” is used to mean “supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.”

2. Install: The term “install” is used to describe operations at project site including actual “unloading, unpacking, rigging in place, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.”

3. Provide: The term “provide” means to “furnish and install, complete and ready for intended use.”

4. Installer: An “installer” is the contractor or an entity engaged by the contractor, either as an employee, subcontractor, or sub-subcontractor for a performance of a particular construction activity, including installation, erection, application and

similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1.03 SUMMARY

A. The work under this Section shall include the furnishing of all materials, labor, equipment and supplies and the performance of all operations to provide complete working systems, in general, to include the following items:

1. Refrigerant Piping and Specialties

2. Drain Piping, Valves and Specialties

3. Electric Heaters

4. Duct Mounted Electric Heating Coil

5. Energy Recovery Ventilation Units, Indoors

6. Multi-Zone Variable Refrigerant Flow (VRF) System, Air Source Heat Pump(s) & Indoor Unit(s)

7. Sheet Metal Ductwork and Accessories

8. Duct, Piping and Equipment Insulation

9. Louvers

10. Escutcheon Plates

11. Hangers, Supports, Anchors, Guides, sleeves and Miscellaneous Steel

12. Vibration Isolation

13. Cutting and Patching

14. Fire Stopping

15. Seismic Provisions

16. Provide a complete system of automatic temperature controls, as shown on the Drawings and called for in this Specification.

17. Systems shall be complete, including all appurtenances for fully workable systems.

B. Provide any other component or related system (whether or not listed) which is part of the overall design and basic equipment and deemed necessary for its completion, thoroughness and readiness for operation in perfect condition.

C. All electrical apparatus and controls furnished as a part of the HVAC work shall conform to applicable requirements under Section 16100 - ELECTRICAL.

D. All work shall be coordinated with the Construction Schedule.

E. Provide energy management system including user interface, software (windows based), graphics, and programming.

F. Commissioning

G. Testing and Balancing of Air Systems

H. Duct Air Leakage Testing

1.04 SHOP DRAWINGS

A. Provide five (3) sets of shop drawings for the following:

1. Refrigerant Piping and Specialties

2. Drain Piping, Valves and Specialties

3. Thermometers and Gauges

4. Electric Unit Heaters

5. Electric Wall Heaters

6. Duct Mounted Electric Heating Coil

7. Energy Recovery Ventilation Units

8. Multi-Zone Variable Refrigerant Flow (VRF) System, Air Source Heat Pump(s) & Indoor Unit(s)

9. Sheet Metal Ductwork and Accessories

10. Duct, Piping and Equipment Insulation

11. Louvers

12. Escutcheon Plates

13. Hangers, Supports, Anchors, Guides, sleeves and Miscellaneous Steel

14. Vibration Isolation

15. Fire Stopping

16. Testing and Balancing Contractor Qualifications

17. Automatic Temperature Controls components complete with wiring diagrams

18. HVAC Equipment Sequence of Operation

19. HVAC System Testing and Balancing Reports

20. HVAC Equipment Start-up Reports

21. Commissioning Documentation for All Installed HVAC Systems and Equipment

1.05 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Provide in accordance with Division 1 for all equipment provided in this section.

1.06 STANDARDS

A. The latest published issue of the standards, recommendations, or requirements of the following listed societies, associations, or institutes in effect at the date of Contract are part of this Specification. These shall be considered as minimum requirements; specific requirements of this specification and/or associated drawings shall have precedence. In case of conflict between published requirements, the Owner's representative shall determine which is to be followed.

1.	AMCA	Air Moving and Conditioning Association
2.	ANSI	American National Standards Institute
3.	ASHRAE	American Society for Heating, Refrigerating, and Air Conditioning Engineers
4.	ASME	American Society of Mechanical Engineers
5.	ASTM	American Society for Testing and Materials
6.	FIA	Factory Insurance Association
7.	IEEE	Institute of Electrical and Electronic Engineers
8.	MCAA	Mechanical Contractors Association of America
9.	NEMA	National Electrical Manufacturers Association
10.	NFPA	National Fire Protection Association
11.	SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
12.	UL	Underwriters' Laboratories, Inc.
13.	OSHA	Occupational Safety and Health Act
14.	NEC	National Electric Code

1.07 CODES, ORDINANCES, AND PERMITS

A. Installation of systems and equipment provided under this section shall be done in strict accordance with Massachusetts Department of Public Safety Codes, Massachusetts Department of Environmental Protection, Massachusetts State Building Code and City of Boston Regulations having jurisdiction.

B. All pressure vessels shall conform to ASME and Massachusetts codes and regulations.

C. All work, where applicable, shall conform to NFPA codes and all material shall be U.L. approved.

D. Give notices, file plans, obtain permits and licenses, pay fees and obtain necessary approvals from authorities having jurisdiction. Deliver certificates of inspection to Engineer. No work shall be covered before examination and approval by Engineer, inspectors, and authorities having jurisdiction. Replace imperfect or condemned work conforming to requirements, satisfactory to Engineer, and without extra cost to the Owner. If work is covered before due inspection and approval, the installing contractors shall pay costs of uncovering and reinstalling the covering, whether it meets contract requirements or not.

1.08 COOPERATION AND COORDINATION WITH OTHER TRADES

A. The work shall be so performed that the progress of the entire building construction including all other trades shall not be delayed nor interfered with. Materials and apparatus shall be installed as fast as conditions of the building will permit and must be installed promptly when and as desired.

B. Confer with all other trades relative to location of all apparatus and equipment to be installed and select locations so as not to conflict with work of other Sections. Any conflicts shall be referred immediately to the Architect for decision to prevent delay in installation of work. All work and materials placed in violation of this clause shall be readjusted to the Architect's satisfaction, at no expense to the Owner.

C. Where work of this section will be installed in close proximity to work of other sections or where there is evidence that the work of this section will interfere with work of other sections, assist in working out space conditions to make satisfactory adjustment. Prepare and submit for approval 3/8 inch scale or larger working drawings and sections, clearly showing how this work is to be installed in relation to the work of other sections. If the work of this section is installed before coordinating with other trades or so as to cause interference with work of other trades, make changes necessary to protect conditions without extra charge.

D. Keep fully informed as to the shape, size and position of all openings required for all apparatus and give information in advance to build openings into the work. Furnish and set in place all sleeves, pockets, supports and incidentals.

E. All distribution systems which require pitch or slope such as storm and sanitary drains and water piping shall have the right of way over those which do not. Confer with other trades as to the location of pipes, lights and apparatus and install work to avoid interferences.

F. This Subcontractor shall, with the approval of the Architect and without extra charge, make reasonable modifications in his work as required by normal structural interferences, or by interference with work of other trades, or for proper execution of the work.

G. This Subcontractor shall protect all materials and work of other trades from damage that may be caused by his work and shall make good any damages so caused.

H. This contractor shall submit Requests for Information (RFI's) regarding the work of this section in accordance with the provisions of Division 1.

1.09 COORDINATION DRAWINGS

A. General: General Contractor shall prepare and provide one accurately scaled set of building "base sheets" in CAD format for production of Coordination Drawings. The Coordination Drawings shall at not less than 1/4 inch for Mechanical and Electrical spaces and at 1/8 inch for all other areas. General Contractor shall establish CAD layer standards for each trade and shall be responsible for distribution to each trade. The sequence of Coordination Drawings shall be Contractor-Structural-HVAC-Electrical-Plumbing-Fire Protection-Contractor. Upon review and approval of coordination drawings, the General Contractor shall provide a complete set to the owner on 4 mil reproducible mylar and electronic files in CAD format.

B. The HVAC Sub-contractor, the Plumbing Sub-Contractor, the Electrical Sub-contractor, Fire Protection Sub-Contractor, and the Contractor shall coordinate all HVAC, plumbing, electrical and sprinkler work with that of each trade, in order to:

1. Avoid interferences between general construction, mechanical, electrical, structural and other specialty trades.

2. Maintain clearances and advise other trades of clearance requirements for operation, repair, removal and testing of mechanical equipment.

3. Indicate aisle ways and access ways required on coordinated shop drawings for mechanical equipment rooms, electrical rooms, computer rooms, and kitchens.

4. Coordinate location of sleeves and inserts, including setting in place prior to pouring concrete.

C. HVAC Coordination Drawings

1. The HVAC Sub-Contractor shall prepare Coordination Drawings showing all work to be installed as part of Section 15500. The Coordination Drawings shall be on 4 mil reproducible mylar at not less than 1/4 inch for Mechanical and Electrical spaces and at 1/8 inch for all other areas. The HVAC Coordination Drawings shall show all equipment, ductwork, pipes, sleeves, inserts, and supports.

2. The HVAC Sub-Contractor, after showing all of the HVAC work, shall forward the reproducible coordination drawings to the Contractor.

3. The HVAC Sub-Contractor shall attend a series of meetings arranged by the Contractor to resolve any real or apparent interferences or conflicts with the work of the other contractors or with ceiling heights shown on the drawings.

4. The HVAC Sub-Contractor shall then make adjustments to his work on the Coordination Drawings to resolve any real or apparent interferences or conflicts and forward to the Contractor.

5. After any real or apparent interferences and conflicts have been incorporated into the Coordination Drawings, the Contractor shall prepare the final Coordination Drawings and submit to the Architect.

6. The HVAC Sub-Contractor shall not install any of his work prior to the preparation of the final Coordination Drawings. If HVAC work proceeds prior to the final Coordination Drawings, any change to the HVAC work to correct the interferences and conflicts which result will be made by the HVAC Sub-Contractor at no additional cost to the Owner.

7. Coordination Drawings are for the HVAC Sub-Contractor's and Architect's use during construction and shall not be construed as replacing any shop, "as-built", or Record Drawings required elsewhere in these Contract Documents.

8. Review of Coordination Drawings shall not relieve the HVAC Sub-Contractor from his overall responsibility for coordination of all work performed pursuant to the Contract or from any other requirements of the Contract.

1.10 CLEANING

A. During the progress of the heating, ventilating and air conditioning work, clean up and remove all oil, grease and other debris caused by this work. At completion, the Contractor shall clean all equipment, piping and duct systems and leave all work in perfect operating condition.

1.11 RESPONSIBILITY

A. The structure and its appurtenances, clearances and the related services, such as plumbing, heating, ventilation and electric service have been planned to be legal, adequate and suitable for the installation of equipment specified under this section. The Owner will not assume any increase in cost caused by differing requirements peculiar to a particular make or type of equipment, and any incidental cost shall be borne by the HVAC Sub-Contractor. He shall be responsible for the proper location of his required sleeves, chases, inserts, etc., and see that they are set in the forms before the concrete is poured. He shall be responsible for his work and equipment furnished and installed by him until the completion and final acceptance of this contract, and he shall replace any work which may be damaged, lost or stolen, without additional cost to the Owner.

1.12 PROTECTION OF MATERIALS, WORK, AND GROUNDS

A. Materials, fixtures and equipment shall be properly protected and all pipe and duct openings shall be temporarily closed so as to prevent obstruction and damage.

B. Protect and preserve all materials, supplies and equipment of every description and all work performed. Protect all existing equipment and property of any kind from damage during the operations. Damage shall be repaired or replaced promptly by the Contractor at his expense.

1.13 GUARANTEE

A. Guarantee that all work installed will be free from any and all defects in workmanship and/or materials and that all apparatus will develop capacities and characteristics specified.

B. If, during a period of one year from the date of final completion and acceptance of the work, any such defects in workmanship, material or performance appear, the HVAC Sub-Contractor will, without cost to the Owner, remedy such defects within a reasonable time to be specified in notice from the Architect.

C. Provide all refrigeration compressors with the manufacturer's extended replacement warranty for a total of five years. All warranties must have been submitted prior to Final Payment.

D. Correct all damage to insulation, paint or building caused by defects in his work, equipment, and its operation. Guarantee shall include startup, shutdown, maintenance, and 24-hour service during the guarantee period.

E. Any apparatus that requires excessive service during the warranty period will be considered defective and shall be replaced.

1.14 PRODUCTS FURNISHED, BUT NOT INSTALLED UNDER THIS SECTION

A. Furnish all access panels and doors required for this Section as specified in Division 08 for installation by General Contractor.

1.15 BASES AND SUPPORTS

A. Furnish and install all supplementary steel required for setting and/or hanging all piping and equipment.

B. Whenever necessary, provide all bases and supports not part of the building structure, of required size, type and strength, as approved by the Engineer or Architect, for all equipment and materials furnished by him.

C. Furnish and install all necessary roof supports for HVAC Equipment located on roof.

1.16 DRAWINGS

A. It is the intention of the Specifications and Drawings to call for finished work, tested and ready for operation. Any apparatus, appliance, material or work not shown on the Drawings, but mentioned in the Specifications or vice-versa, or any incidental accessories necessary to make the work complete in all respects and ready for operation, even if not

particularly specified, shall be provided by the Contractor without additional expense to the Owner.

B. The Drawings are generally diagrammatic. The locations of all items that are not definitely fixed by dimensions are approximate only. The exact locations must be determined at the project and shall have the approval of the Engineer before being installed. The Contractor shall follow Drawings, including his shop drawings, in laying out work and shall check the Drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions. Where space conditions appear inadequate, notify the Engineer before proceeding with the installation. The Contractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.

C. Size of ducts and pipes and methods of running them are shown, but it is not intended to show every offset and fitting, nor every structural difficulty that may be encountered. To carry out the true intent and purpose of the Drawings, all necessary parts to make complete approved working systems ready for use, shall be furnished without extra charge. All work shall be installed in such a manner as to avoid being unsightly.

D. All measurements shall be taken at the building by the Contractor, prior to purchasing and installing the equipment and piping.

1.17 VERIFYING CONDITIONS

A. Before commencing any work under this section, verify all governing dimensions and examine all adjoining work on which this work is in any way associated or connected. Failure to visit the jobsite will in no way relieve the Contractor from installing the work according to the intent of these specifications and at no additional cost to the Owner.

B. Each bidder shall visit the site and inspect conditions affecting the proposed work. Failure to do so and misinterpretation of the Plans and Specifications resulting there from shall be entirely the responsibility of the bidder.

1.18 UNDERWRITERS' LABEL AND LISTING

A. All electrical apparatus furnished under this Section shall be approved by the UL and shall be labeled or listed where such is applicable. Where custom-built equipment is specified and the UL label or listing is not applicable to the completed product, all components used in the construction of such equipment shall be labeled or listed by UL where such is applicable to the component.

1.19 CUTTING, CORING AND PATCHING

A. All cutting, coring and patching one (1) square foot and less in area necessary for the proper installation of work to be performed under this Section and subsections shall be performed by the HVAC Sub-Contractor. All cutting and patching associated with demolition work and greater than one (1) square foot in area for the installation of work under this section shall be by the General Contractor.

B. All work shall be fully coordinated with all phases of construction, in order to minimize the requirements for cutting and patching.

C. The contractor shall see that all such chases, openings, and sleeves are located accurately and are of the proper size and shape and shall consult with the Engineer in reference to this work. In so doing, he shall confine the cutting to the smallest extent possible consistent with the work to be done. In no case shall piers or structural members be cut without the approval of the Engineer.

D. Carefully fit around, close up, repair, patch, and point around the work specified herein to the entire satisfaction of the Engineer.

E. Fill and patch all openings or holes left in the existing structures by the removal of existing equipment by himself, his subcontractors or other filed subcontractors.

F. All of this work shall be carefully done by workmen competent to do such work and with the proper and smallest tools applicable.

G. Any cost caused by defective or ill-timed work shall be the contractor's responsibility therefore.

H. The fire resistance rating of floors, walls, and ceilings shall be maintained. UL listed fire stopping shall be installed in accordance with manufacturer's written instructions. Refer to Division 07 for detailed fire stopping requirements.

1.20 ELECTRICAL

A. All electrical apparatus and controls furnished as a part of this Section shall conform to applicable requirements under Section Division 26 00 00 - ELECTRICAL.

B. All motors furnished under this Section shall be furnished by the manufacturer of the equipment served and shall be mounted and aligned so as to run free and true. Each motor shall be built to conform to the latest applicable NEMA, ANSI and IEEE standards for the type and duty of service it is to perform.

C. Each motor shall be designed to operate on 60 Hz, and each shall be expressly wound for the voltage specified. Each motor shall operate satisfactorily at rated load and frequency with a voltage variation no greater than plus or minus 10 percent of voltage specified. Dual voltage 208/220 motors will not be accepted.

D. All motors shall be provided with adequate starting and protective equipment and each shall have a terminal box of adequate size to accommodate the required conduit and wires.

E. Motor controllers shall be equipped with all poles, auxiliary contacts and other devices necessary to permit the interlocking and control sequences required. Controller operating coils shall be generally designed for 120 volt operation, and 3 phase motors shall be provided with thermal overload protection in all phases.

F. Furnish all magnetic starters for each and every motor furnished under this section of the specification, except where otherwise indicated. The Electrical Sub-Contractor shall install and wire the starter. The Contractor shall provide disconnects for all HVAC equipment. The Electric Sub-Contractor shall install and wire all disconnects. All starters for motors over 10 HP shall be solid state with reduced inrush design. The maximum allowable inrush shall be 2.5 times running load amperage. All starters for fractional HP motors shall be provided with manufacturer's standard motor starter.

G. Furnish and install all low voltage and/or line voltage control wiring for the boiler/burner units, chillers, cooling towers, pumps, and fans. All wiring shall be performed by a licensed electrician.

H. Each bidder shall make note of the existing conditions affecting hauling, rigging, transportation, installation, etc., in connection with his work and shall make all provisions for transportation of all materials and equipment.

I. Where field conditions require, the Contractor shall arrange for equipment to be shipped to the job, dismantled and assembled in place.

J. Remove walls, window assemblies/glass and floor structures where necessary to install and remove equipment as shown. The Contractor shall reinstall such displaced structures to their original condition.

1.21 CONCRETE WORK

A. All masonry and concrete pads for all trades and sub-trades shall be provided by the General Contractor, in accordance with Division 3.

1.22 PAINTING

A. All finish field painting shall be provided in accordance with Division 9.

1.23 TEMPORARY FACILITIES

A. The general contractor is responsible for providing temporary heat to the building during construction.

1.24 SEISMIC RESTRAINT REQUIREMENTS

A. For each seismic restraint, provide certified calculations to verify adequacy to meet the following design requirements:

1. Ability to accommodate relative seismic displacements of supported item between points of support.

2. Ability to accommodate the required seismic forces.

B. For each respective set of anchor bolts provide calculations to verify adequacy to meet combined seismic-induced sheer and tension forces.

C. For each weldment between structure and item subject to seismic force, provide calculations to verify adequacy.

D. Calculations shall be stamped by a professional engineer who is registered in the Commonwealth of Massachusetts and has specific experience in seismic calculations.

E. Restraints shall maintain the restrained item in a captive position without short circuiting the vibration isolation.

F. Provide seismic restraints for all piping, ductwork and equipment in accordance with the requirements of the Massachusetts State Building Code, 780 CMR, latest edition, and referenced requirements of IBC and NFPA.

1.25 HOISTING, SCAFFOLDING AND PLANKING

A. All derricks, hoisting machinery, scaffolds, staging and planking required for the work of the HVAC filed sub-bid contractor shall be furnished, set-up and maintained by the General Contractor. The HVAC sub-contractor shall coordinate all such requirements for this work with the General Contractor. Refer to Section 015000, Par. 1.07 for further instructions.

1.26 SEQUENCING

A. Coordinate work of this Filed Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.

B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed Subcontract, have been received and approved by the Architect.

C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

1.27 RECORD DRAWINGS

A. Refer to DIVISION 1 – PROJECT CLOSEOUT, of the Specifications for record drawings and procedures to be provided under this section.

1.28 FINAL ACCEPTANCE

A. Final acceptance of Ownership of the HVAC system installed within this scope of work shall be contingent on passing a satisfactory system pressure test, mechanical performance test and cooling and heating function test to determine that the system will perform according to the contract requirements. The above tests shall be witnessed by the Engineer and the Owner at his option and acceptance will only be granted in writing by the Owner after receipt of certification from the Engineer that the design criteria have been met.

B. The work shall be so performed that the progress of the entire building construction, including all other trades, shall not be delayed or interfered with. Materials and apparatus shall be installed as fast as conditions permit and must be installed promptly when and as desired.

C. Confer with all other trades relative to location of all apparatus and equipment to be installed and select locations so as not to conflict with work of other Sections. Any conflicts shall be referred immediately to the Engineer for decision to prevent delay in installation of work. All work and materials placed in violation of this clause shall be readjusted to the Engineer's satisfaction, at no expense to the Owner.

D. Where work of this section will be installed in close proximity to work of other sections or where there is evidence that the work of this section will interfere with work of other sections, assist in working out space conditions to make satisfactory adjustment. If so directed, prepare and submit for approval 3/8 inch scale or larger working drawings and sections, clearly showing how this work is to be installed in relation to the work of other sections. If the work of this section is installed before coordinating with other trades or so as to cause interference with work of other trades, make changes necessary to protect conditions without extra charge.

E. Contractor shall provide to the Owner and the Sustainability Consultant copies of all invoices for Mechanical equipment to be included in NStar Incentive Applications. A list of the equipment to require invoices will be provided to the Contractor by the Owner and Sustainability Consultant.

PART 2 - PRODUCTS

2.01 REFRIGERANT PIPING AND SPECIALTIES

A. Furnish all pipe and fittings required for the HVAC systems, including refrigerant liquid (RLL), refrigerant suction (RLS) piping and A/C condensate drain (CD) piping.

B. Refrigerant Piping (RLL, RLS):

1. Pipe: Type L hard drawn ACR tubing, ASTM B280.

2. Fittings: Wrought copper, ANSI B16.22.

3. Joints: Silver solder, minimum 45% silver brazing alloy, cadmium free, ASTM B32

4. The refrigerant piping shall be rated for the maximum operation pressure of R410A air conditioners, 623psi. Pipes of radial thickness 0.7mm or less shall not be used.

C. Provide dielectric unions at all connections of dissimilar metals. Dielectric unions shall be factory certified to withstand a minimum of 600 volts on a dry line with no flashover, rated 250 psig and conforming to ANSI B16.39. Dielectric union and flange pipe threads shall conform to ANSI B2.1.

D. Refrigerant Systems Accessories:

1. Refrigerant Solenoid Valve: Provide a valve with sweat type valve connections, ductile iron and brass body construction, stainless steel and brass internal parts, teflon diaphragm, neoprene pilot seat, stainless steel springs and 120 volt/60 Hz coil assembly. Valve shall be sized in accordance with manufacturer's printed instructions.

2. Thermal Expansion Valves: Provide valves of brass body with copper fittings, stem-less steel diaphragms, brass and stainless steel internal parts, replaceable power element, factory maximum operating pressure charge to maintain super heat control over evaporator temperature range, 1/4" external equalizer connection, sweat connection in a straight through flow configuration and remote bulb with 60" tubing length.

3. Hot Gas Bypass Pressure Regulating Valve: Provide valves of brass body with copper fittings, stainless steel diaphragm, brass and stainless steel internal parts, 1/4" external equalizer connection and sweat connection in a straight through flow configuration. Valves shall be sized for effective part connections in accordance with manufacturer's printed instructions.

4. Refrigerant Sight Glass Moisture Indicator: Provide device of copper plated steel construction, removable leak proof fused sight glass with universal indicator element for R-22, clear liquid viewing area, scratch resistant glass and O-Ring for leak proof seal. Valve shall have sweat connections.

5. Liquid Line Filter Dryers: Provide filter dryers of heavy gauge steel shell with corrosion resistant paint, copper plated sweat fittings, perforated baffle support plates, and filled with chemically inert molecular sieve head capable of filtering contaminated particles down to 20 microns.

6. Pressure Relief Valves: Shall be of relief setting as indicated. Valves shall be of cast iron bodies with bronze seat rings in frame and flap and with bronze hinge pins. Provide relief valve discharge piping to nearest floor drain. Valves shall be sized at indicated relief pressure in accordance with manufacturer's printed recommendations.

7. Flexible Piping Connections: Provide at refrigerant piping connections to outdoor units. Connections to be braided bronze construction with copper sweat ends; working pressure suitable for pressures encountered in systems.

2.02 HYDRONIC PIPING, VALVES & SPECIALTIES

A. Furnish all pipe and fittings required for the HVAC systems, including refrigerant liquid (RLL), refrigerant suction (RLS) piping and A/C condensate drain (CD) piping.

B. Drain (CD) piping shall be Type L hard drawn copper, ASTM B88 with wrought copper ANSI B16.22 fittings. Joints shall be soldered, ASTM B32, with 95/5 solder.

C. Provide dielectric unions at all connections of dissimilar metals. Dielectric unions shall be factory certified to withstand a minimum of 600 volts on a dry line with no flashover, rated 250 psig and conforming to ANSI B16.39. Dielectric union and flange pipe threads shall conform to ANSI B2.1.

D. Unions for copper pipe shall be bronze, ground joint, 600 psi WOG, sweat or thread end as required.

E. Ball valves, check valves and draw-off valves shall be Powell, Lunkenheimer, Crane, or approved equal. Figure numbers herein are Powell numbers.

1. Valves 2″ and smaller shall be ball valves. Ball valves shall be Jenkins Figure 32-A, Crane, Stockham or approved equal, bronze ball valves with bronze ball, Teflon seats, brass stem and cadmium plated steel handle with plastic grips.

2. Check valves 2" and smaller shall be Figure 578, 125# bronze, horizontal swing type with regrinding bronze seat and disc, screwed end.

3. Draw-off valves shall be Figure 503H, bronze, screwed inlet, hose outlet.

F. Strainers

1. Provide a "Y" type full size strainer as indicated on the Drawings.

2. An approved dirt blowout connection shall be made to each strainer, with 1" Jenkins Figure 372 and Figure 658 cap and chain; the valve located six inches to twelve inches below the strainer. In the case of strainers under full water pressure, the blowout connection shall terminate at a point where there will be no risk of flooding or damage.

3. Strainers 2" diameter and smaller shall have screwed ends. Strainers 2-1/2" diameter and larger shall have flanged ends.

4. Strainers 2" and smaller shall be full size, bronze, "Y" pattern: Tate Temco Figure IY, Spirax Sarco, Mueller or approved equal.

5. Strainers 2-1/2"or larger shall be cast steel body, "Y" type; Tate Temco figure IY, Spirex Sarco, Mueller or approved equal, 150 psi rating.

6. Total open area of basket perforations shall be at least three times the inside area of pipes.

7. Strainer baskets shall be stainless steel with 1/16" perforations (up to 2" size) and 1/8" perforations (2-1/2" and larger).

G. Thermometers and Pressure Gauges

1. Thermometers and pressure gauges shall be Trerice, Ashcroft, Taylor or approved equal complete with all required wells. Model numbers used are Trerice numbers.

2. Thermometers shall be Model BX9, industrial thermometers, adjustable angle, 9" case.

3. Thermometer ranges shall be 0 °F to 200 °F for use in hot water piping.

4. Pressure gauges shall be Model 500 X.

2.03 ELECTRIC BASEBOARD HEATERS

A. Heaters shall be low profile (3” x 5-1/2” x 7”, 5” x 14”) and available in lengths from 28 inches through 10 feet.

B. Enclosures shall be 16-gauge, furniture quality steel with reinforced, all welded construction; designed to withstand heavy-duty commercial and institutional use. Enclosures shall be chemically-treated to resist corrosion. Finish shall be mar and temperature-resistant to retain contemporary appearance throughout years of rough use.

C. For safety, the electric heating bank shall consist of metal sheath heating elements. The elements shall have a copper clad steel for strength and corrosion resistance, and aluminum fins for faster heat transfer. One, two, or three, low density elements shall be installed side-by-side on the same plane to uniformly warm all incoming air. Elements shall be center-anchored and shall float freely on each end through nylon bushings for quietness.

D. Discharge louvers shall be closely spaced steel to direct heat away from wall and to minimize wall surface temperatures and control dirt streaking. A 1/4-inch mesh screen shall be installed beneath the discharge grille to deter the insertion of foreign objects.

E. Optional built-in controls shall include single-pole, double-pole, or two-stage thermostats, power on/off switch, transformer relay and power relay. The thermostat shall be capable of controlling multiple units on a pilot duty circuit. (Observe the control limitations indicated.) Thermostat adjustment shall be with a thin-bladed screwdriver through the discharge louvers and shall be considered tamper-resistant.

F. An automatic reset thermal overheat protector shall run the full-length of the heater and shall turn off heating elements should overheating occur at any point along heating length. Overheat protector shall restore operation automatically when cause of overheating is removed.

G. Heaters shall be designed with a built-in pre-wired raceway to enable multiple unit wiring form one feeder source.

H. Back panel shall be one-piece heavy gauge painted steel completely finished, and shall be suitable for mullion to mullion mounting in front of a glass curtain wall. 28-inch control sections, finished to match the heating units, shall be available with factory built-in mercury contactors, circuit breakers, control transformer, PE, switch or SCR controls. This control section shall also be furnished blank, as an optional accessory, for field installation of controls.

I. All heaters and electrical accessories shall be labeled by Underwriters' Laboratories, Inc. Accessories shall include end caps, blank sections (28" blank sections shall be designed for field-cutting), inside and outside corners, splice plates, and telescoping filler sections. All accessories shall be completely enclosed to enable the installer to pull standard wiring form heater to heater through the accessories.

2.04 ELECTRIC WALL HEATERS

A. The heating equipment shall include electric, automatic fan forced air heater suitable for large area heating, as manufactured by QMark, Steibel-Eltron, Broan-Nutone or approved equal. The heater shall be designed for wall recess or surface mounting. Heaters shall be UL listed or equivalent (ETL).

B. The heater shall be made up of a back box, a heater assembly and a front panel

C. The back box shall be 20-gauge galvanized steel and shall contain knockouts through which power leads are brought. The back box shall be designed for duty as a recessed rough-in box in either masonry or frame construction, and is also used with the surface mounting frame in surface mounting applications.

D. The heater assembly shall consist of a fan panel mounted completely within the back box, all of the operational parts of the heater shall be mounted on the fan panel.

E. The front panel shall be of the bar grille type and shall be constructed of 16-gauge cold-rolled steel, welded into a uniform grille to direct the warmed air toward the floor. The front grille shall be surrounded by a decorative satin-finish aluminum "picture" frame.

F. The heating element shall be of the non-glowing design consisting of a special resistance wire enclosed in a steel sheath to which steel plate fins are copper brazed. The element shall be warranted for 5 years.

G. The fan shall be five-bladed aluminum and the fan motor shall be totally enclosed. Fan control shall be of bi-metallic, snap-action type and shall activate fan after heating element reaches operating temperature. The fan shall continue to operate after the thermostat is satisfied and until the heating element is cool.

H. The tamper-proof thermostat shall be of the bi-metallic snap-action type with enclosed contacts. It shall be completely concealed behind the front cover as to be tamper proof.

I. A manual-reset thermal cutout shall be built into the system to shut off the heater in the event of overheating.

J. A double-pole, single throw ON/OFF switch shall be mounted on the back box for positive disconnect of power supply. It will be completely concealed behind the front grille panel.

K. 24-volt and 120-volt low voltage relays shall be available as optional equipment to control 208, 240 or 277 volt heaters in conjunction with central energy control systems. The built-in thermostat can then be used as one of the thermostats in an automatic night set back operation.

2.05 ELECTRIC UNIT HEATERS

A. Heater shall be a horizontal air delivery electric unit heater of the size, capacity, and voltage as listed in the equipment schedule as manufactured by QMark, Modine, Reznor or approved equal. The heater shall be UL listed or equivalent (ETL) for safe operation, construction and performance. Heaters shall meet all UL, NEC, and OSHA requirements

B. Unit shall mount either horizontally or vertically as indicated.

C. Unit shall have a heavy gauge, die-formed steel casing that is treated for corrosion resistance and painted with an electrostatically applied, baked on, polyester powdercoat paint finish. The unit shall have a squared corner casing and the top shall have two threaded holes (3/8" - 16 TAP) for threaded rod suspension. The bottom of casing shall have a hinged panel for service access to wiring and controls

D. The heating elements shall consist of an Aluminum-finned, copper clad steel sheathed wire or nickel-chromium resistance wire surrounded with magnesium oxide and sheathed in steel spiral-finned tubes. Elements shall have kilowatt rating as listed in the equipment schedule.

E. Each unit shall have a single, totally enclosed, continuous-duty fan motor with automatic resetting, thermal-overload protection. Propeller fan shall be directly connected to the motor shaft and be statically balanced. The motor shall be mounted to the unit with rubber vibration absorbing material.

F. All units shall have built-in contactors and control circuit transformers (where required) to provide single-source power connection. With single or 3-phase wiring on 5 through 10 KW 208/240V and 15 KW 208V units (field interchangeable).

G. Control transformers (24V) shall be factory installed on all models with 460 and 600 volt, 3-phase power supply to permit 230 volt motor operation. 3KW and 5KW, 208-277V, shall have line voltage controls as standard (24V control option available).

H. Heaters to be provided with capillary type automatic reset linear thermal cut-out.

I. Fan control shall activate fan after heating element reaches operating temperature. The fan shall continue to operate after the thermostat is satisfied and until the heating element is cool.

J. Individually adjustable discharge louvers shall be provided to control air flow direction.

2.06 ENERGY RECOVERY VENTILATION UNITS, INDOORS

A. Energy recovery ventilator shall be a packaged unit as manufactured by RenewAire, Mitsubishi, ConsERV or approved equal. Substitutions shall be allowed only after review and approval by Architect and Engineer provided all specifications are met and performance is in compliance with project design and certification requirements. The unit shall transfer both sensible and latent energy using static plate core technology with airflows, electrical characteristics and all accessories as scheduled.

B. The ERV unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, control circuit board and blowers with motors, filters, and insulated foam air guides. Each unit will have an automatic by-pass damper system for economic operation under certain conditions. The unit shall have factory installed control board with functions for local, remote, and optional control modes.

1. Unit Cabinet:

   a. The cabinet shall be fabricated of galvanized steel, and covered with polyurethane foam insulation as necessary with steel mounting points securely attached

2. Blowers:

   a. The unit shall be furnished with two (2) or four (4) direct drive centrifugal blowers running simultaneously supplying and extracting air at the same rate for balanced ventilation air flow.

   b. The blower motors shall be directly connected to the blower wheels and have permanently lubricated bearings.

   c. The blowers and motors shall be mounted for quiet operation.

3. Heat Exchanger

   a. The energy transfer core shall be constructed of specially treated cellulous fiber membrane separated by corrugated layers to allow total heat (sensible and latent) energy recovery from the exhaust air to the supply air or from the supply air to the exhaust air as determined by design conditions.

   b. The energy transfer core shall have protective MERV-8 rated, 2" nominal, pleated, disposable filter installed at both the supply and exhaust sides with an access cover for maintenance.

4. Bypass Damper (where indicated)

   a. The ERV shall have an automatic supply side by-pass damper to allow inbound ventilation air to by-pass the energy transfer core when outside weather conditions warrant.

   b. The mechanism for opening and closing the bypass damper shall be a 208V-230V synchronous electric motor through an actuator. The motor will drive a steel cable connected to an mechanical damper flap to allow fresh air to bypass the energy transfer core.

   c. Supply and return air thermistor shall control the damper and may be interlocked with a LCD remote controller.

5. Filter

a. The ERV shall be equipped with factory installed air filters located at each intake face (both supply and exhaust sides) of the energy transfer core.

6. Mounting

a. Mounting of the ERV shall be as indicated in the plans and drawings. The ERV shall not require and condensate pan or receptacle nor condensate drain or piping. Mounting may be horizontal or vertical and the unit may be inverted as required by ductwork connection.

7. Electrical

a. The units will require a 208-230Volt, 1 Phase, 60Hz power supply.

8. Control

a. A 30vdc fuzzy logic signal generated by a City Multi System via a 2 conductor non polar shielded, jacketed control wire to a PZ-60DR-E Mitsubishi Electric LCD remote controller or interlocked with a City Multi indoor unit.

C. Performance:

1. The ERV units shall have the following nominal capacities:

Model Number	Nominal Airflow	External Static Capacity (In. W.G.) at Nominal Airflow (208V)
HE-1X-INH	550 CFM	1.0
HE-1.5X-INV	1100 CFM	1.0

2. The temperature recovery efficiency at extra low fan speed will be as follows:

Model Number	Temperature Recovery (208V)	Enthalpic Recovery (208V)	
		Heating	Cooling
HE-1X-INH	75.6%	75.5%	60.3%
HE-1.5X-INV	71.5%	71.4%	55.0%

Performance Certified to ARI Standard 1060

3. The ERV operating sound level shall not exceed the following levels at maximum fan speed:

Model Number	Sound Level dB(A) 59in Under Center of Unit (208/230V)

HE-1X-INH	---
HE-1.5X-INV	---

D. Preheater (For Winter Design Temperature Less than 14°F):

1. A suitable pre-heater shall be supplied and installed to pre-heat and maintain the air entering the ERV to above 14°F.

2. The heater shall be sized to increase the temperature of the incoming supply air based on the heating (winter) design condition of the applicable site.

3. In the case where the outside air is mixed into the return air of an indoor unit fan coil unit the pre-heater will be sized so that the mixed air temperature of return and ventilation air is always greater than 55°F.

4. The pre-heater shall be installed according to the manufacturer's recommendation.

E. The energy recovery cores used in these products shall be third party Certified by AHRI under its Standard 1060 for Energy Recovery Ventilators. AHRI published certifications shall confirm manufacturer's published performance for airflow, static pressure, temperature and total effectiveness, purge air (OACF) and exhaust air leakage (EATR). Products that are not currently AHRI Certified will not be accepted. OACF shall be no more than 1.02 and EATR shall be at 0% against balanced airflow.

F. Manufacturer shall be able to provide evidence of independent testing of the core by Underwriters Laboratory (UL), verifying a maximum flame spread index (FSI) of 25 and a maximum smoke developed index (SDI) of 50 thereby meeting NFPA 90A and NFPA 90B requirements for materials in a compartment handling air intended for circulation through a duct system. The method of test shall be UL Standard 723.

G. Unit shall be listed under UL/ETL 1812 Standard for Ducted Air to Air Heat Exchangers and comply with CSA Standard 22.2. Some exceptions to UL Listing may apply. Units intended for "Outdoor Use" shall be listed using the specific UL requirements for rain penetration, corrosion protection and seal durability and shall be so labeled.

H. The ERV core shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of ten years from the date of purchase. The balance-of-unit shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of two years from the date of purchase.

I. General Construction

1. The energy recovery component shall be of fixed-plate cross-flow construction, with no moving parts.

2. No condensate drain pans or drains shall be allowed and unit shall be capable of operating in both winter and summer conditions without generating condensate.

3. The unit case shall be constructed of G90 galvanized, 20-gauge steel, with lapped corners and zinc-plated screw fasteners. The unit roof shall be one piece or have watertight standing seam joints and shall overlap wall panels and doors in order to positively shed water.

4. Access doors shall provide easy access to blowers, ERV cores, and filters. Doors shall have an airtight compression seal using closed cell foam gaskets rated for outdoor exposure. Pressure taps, with captive plugs, shall be provided allowing cross-core pressure measurement allowing for accurate airflow measurement.

5. Unit shall have single-point power connection and a single-point 24 VAC contactor control connection.

J. Options

1. Provide unit and duct connection orientation per project schedule.

2. Provide ECM controlled motors allowing pre-set or variable speed operation with a 0-10 volt DC control signal.

3. Provide automatic motorized control dampers for both air streams. The insulated dampers shall be of a low leakage design and shall not restrict the airstream, reducing airflow, in any way. The dampers shall be opened with a motor actuator and have a spring return for low off-position power consumption.

4. Provide MERV-13 filters for final installation after construction phase.

K. Installation

1. Locate, orient, and connect ductwork per AMCA, ASHRAE, and SMACNA guidelines. Provide service clearances as indicated on the plans. Locate units distant from sound critical occupancies.

2. Install a structurally sound, weathertight, level and properly insulated roof curb with nailers, curb gasket and tie-downs to meet local wind load requirements.

3. Ductwork:

a. The installer shall supply, install, test and commission all interconnecting ductwork for the ERV unit(s).

b. Ductwork sizing, layout, fittings, etc. shall be in strict accordance with the design requirements.

c. The two outdoor ducts must be covered with heat insulating material in order to prevent condensation from forming.

d. The two outdoor ducts must be tilted at a gradient (1/30 or more) down toward the outdoor area from the ERV unit.

L. Vibration Isolation

1. Provide spring type vibration rails or curb to match the specific unit corner weights.

2. Provide flexible duct connections at unit duct flanges.

M. Sound Control

1. Provide straight, gradual transition ductwork for a minimum of 2-1/2 duct diameters downstream from the blower outlet for air velocities of less than 2,500 feet per minute.

N. Test and Balancing

1. Test and Balancing may not begin until 100% of the installation is complete and fully functional.

2. Follow National Environmental Balancing Bureau (NEBB) air test and balance procedures specific to energy recovery devices. Provide balancing reports to owner's representatives.

2.07 DUCT MOUNTED ELECTRIC HEATING COIL

A. Furnish and install where indicated on plans, electric heating coil, suitable for duct mounting with horizontal or vertical airflow and for continuous operation. Heaters shall be as manufactured by Renewaire, Greenheck (model IDHC), QMark (model FC) or approved equal. Heaters shall be UL listed.

B. Duct heaters shall be of heavy gage galvanized steel construction, rated for zero-clearance and provided with flush-mounted control box having hinged access panel. Heaters shall be of the capacity, electrical characteristics and dimensions as scheduled. All units shall be pre-wired for power and control with automatic thermal over-protection and reset.

C. Duct heaters shall be provided with the following options:

1. Disconnect switch

2. Fan operation interlock

3. SCR control and duct thermostat

4. 80% nickel, 20% chromium element wire

2.08 MULTI-ZONE VRF SYSTEM, AIR SOURCE HEAT PUMP (HP) & INDOOR FAN COIL (FCU) UNITS

A. General

1. Per the equipment schedule, the variable capacity, heat pump heat recovery air conditioning system basis of design is Mitsubishi Electric City Multi VRF (Variable Refrigerant Flow) zoning system(s).

2. Acceptable alternative manufacturers, assuming compliance with these equipment specifications, are Fujitsu, Panasonic, Daikin or approved equal. Contractor bidding an alternate manufacturer does so with full knowledge that that manufactures product may not be acceptable or approved and that contractor is responsible for all specified items and intents of this document without further compensation.

3. Simultaneous heating/cooling (heat recovery) systems shall consist of an outdoor unit, BC (Branch Circuit) Controller (or comparable branch devices), multiple indoor units, and an integral DDC (Direct Digital Controls) system. Each indoor unit or group of indoor units shall be capable of operating in any mode independently of other indoor units or groups. System shall be capable of changing mode (cooling to heating, heating to cooling) with no interruption to system operation. To ensure owner comfort, each indoor unit or group of indoor units shall be independently controlled and capable of changing mode automatically when zone temperature strays 1.8 degrees F from set point for ten minutes.

4. No additional branch circuit controllers (or comparable branch devices) than shown on the drawings/schedule may be connected to any one outdoor unit. Contractors proposing alternate systems requiring more branch devices than those included as the basis of design are responsible for additional piping & electrical costs and are required to identify additional costs & installation time required of other trades with their bid.

5. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.

6. All wiring shall be in accordance with the National Electrical Code (N.E.C.).

7. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

8. All units must meet or exceed the 2010 Federal minimum efficiency requirements and the ASHRAE 90.1 efficiency requirements for VRF systems. Efficiency shall be published in accordance with the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standard 1230.

9. System start-up supervision shall be a required service to be completed by the manufacturer or a duly authorized, competent representative that has been factory trained in system configuration and operation. The representative shall provide proof of manufacturer certification indicating successful completion within no more than two (2) years prior to system installation. This certification shall be included as part of the equipment and/or controls submittals.

10. Unit shall be stored and handled according to the manufacturer's recommendation.

11. Warranty

a. The City Multi units shall be covered by the manufacturer's limited warranty for a period of one (1) year parts and seven (7) year compressor to the original owner from date of installation.

b. Installing contractor shall meet manufacturer requirements to obtain extended manufacturer's limited parts and compressor warranty for a period of ten (10) years to the original owner from date of installation. This warranty shall not include labor.

c. Manufacturer shall have a minimum of fifteen (15) years continuous experience providing VRF systems in the U.S. market.

d. All manufacturer technical and service manuals must be readily available for download by any local contractor should emergency service be required. Registering and sign-in requirements which may delay emergency service reference are not allowed.

e. The City Multi VRF system shall be installed by a contractor with extensive City Multi install and service training. The mandatory contractor service and install training should be performed by the manufacturer.

B. Outdoor Heat Pump Unit(s)

1. The outdoor unit modules shall be air-cooled, direct expansion (DX), multi-zone units used specifically with VRF components described in this section. The outdoor unit modules shall be equipped with a single compressor which is inverter-driven and multiple circuit boards—all of which must be manufactured by the branded VRF manufacturer. Each outdoor unit module shall be completely factory assembled, piped and wired then run tested at the factory.

2. Outdoor unit systems may be comprised of multiple modules with differing capacity if a brand other than basis of design is proposed. All units requiring a factory supplied twinning kits shall be piped together in the field, without the need for equalizing line(s). If an alternate manufacturer is selected, any additional material, cost, and labor to install additional lines shall be incurred by the Contractor. It shall be the Contractor's responsible for ensuring alternative brand compatibility in terms of availability, physical dimensions, weight, electrical requirements, etc.

3. Outdoor unit shall have a sound rating no higher than 68 dB(A) individually or 70 dB(A) twinned. Units shall have a sound rating no higher than 52 dB(A) individually or 55 dB(A) twinned while in night mode operation. Units shall have 5 levels sound adjustment via dip switch selectable fan speed settings. If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.

4. Refrigerant lines from the outdoor unit to the indoor units shall be insulated in accordance with the installation manual and as indicated in the Contract Documents.

5. The outdoor unit shall have the capability of installing the main refrigerant piping through the bottom of the unit.

6. The outdoor unit shall have an accumulator with refrigerant level sensors and controls. Units shall actively control liquid level in the accumulator via Linear Expansion Valves (LEV) from the heat exchanger.

7. The outdoor unit shall have a high-pressure safety switch, over-current protection, crankcase heater and DC bus protection.

8. VRF system shall meet performance requirements per schedule and be within piping limitations & acceptable ambient temperature ranges as described in respective manufacturers' published product catalogs. Non-published product capabilities or performance data are not acceptable.

9. The outdoor unit shall be capable of operating in heating mode down to -25°F ambient temperatures or cooling mode down to 23°F ambient temperatures, without additional low ambient controls. If an alternate manufacturer is selected, any additional material, cost, and labor to meet low ambient operating condition and performance shall be incurred by the contractor.

10. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained. Oil return sequences must be enabled only during extended periods of reduced refrigerant flow to ensure no disruption to correct refrigerant flow to individual zones during peak loads. Systems which might engage oil return sequence based on hours of operation risk oil return during inopportune periods are not allowed. Systems which rely on sensors to engage oil return sequence are not allowed.

11. Unit must defrost all circuits simultaneously in order to resume full heating more quickly during extreme low ambient temperatures (below 23°F). Partial defrost, also known as hot gas defrost which allows reduced heating output during defrost, is permissible only when ambient temperature is above 23°F.

12. While in hot gas defrost the system shall slow the indoor unit fan speed down to maintain a high discharge air temperature, systems that keep fan running in same state shall not be allowed as they provide an uncomfortable draft to the indoor zone due to lower discharge air temperatures.

13. In reverse defrost all refrigerant shall be bypassed in the main branch controller and shall not be sent out to the indoor units, systems that flow refrigerant through indoor units during reverse defrost shall not be allowed.

14. The outdoor unit shall be provided with a manufacturer supplied 20-gauge hot dipped galvanized snow /hail guard. The snow/hail guard protects the outdoor coil surfaces from hail damage and snow build-up in severe climates.

15. VRF four-legged outdoor unit mounting systems shall be provided by manufacturer. Stand shall be made from 7-gauge plate steel with thermally fused polyester powder coat finish that meets ASTM D3451-06 standards. Stands shall

be provided with galvanized mounting hardware and meets all ASCE 7 overturning safety requirement.

16. Unit Cabinet:

    a. The casing(s) shall be fabricated of galvanized steel, bonderized and finished.

    b. The outdoor unit shall be tested in compliance with ISO9277 such that no unusual rust shall develop after 960 hours of salt spray testing.

    c. Panels on the outdoor unit shall be scratch free at system startup. If a scratch occurs the salt spray protection is compromised and the panel should be replaced immediately.

17. Fan:

    a. Each outdoor unit module shall be furnished with direct drive, variable speed propeller type fan(s) only. Fans shall be factory set for operation at 0 in. WG. external static pressure, but capable of normal operation with a maximum of 0.32 in. WG. external static pressure via dipswitch.

    b. All fan motors shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.

    c. All fans shall be provided with a raised guard to prevent contact with moving parts.

18. Refrigerant and Refrigerant Piping:

    a. R410A refrigerant shall be required for systems.

    b. Polyolester (POE) oil shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval prior to bidding.

    c. Refrigerant piping shall be phosphorus deoxidized copper (copper and copper alloy seamless pipes) of sufficient radial thickness as defined by the VRF equipment manufacturer and as indicated in the Contract Documents. All piping shall be installed in accordance with manufacturer recommendations.

    d. All refrigerant piping must be insulated with closed cell, CFC-free foam insulation with flame-Spread Index of less than 25 and a smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102. Insulation thickness shall be as noted in Contract Documents and R value of insulation shall in no cases be less than 3.

e. Refrigerant line sizing shall be in accordance with manufacturer specifications. Future changes to indoor unit styles or sizes must be possible without resizing/replacing refrigerant piping to any other branch devices or indoor units.

19. Coil:

a. Outdoor Coil shall be constructed to provide equal airflow to all coil face surface are by means of a 4-sided coil

b. Outdoor Coil shall be elevated at least 12" from the base on the unit to protect coil from freezing and snow build up in cold climates. Manufacturers in which their coil extends to within a few inches from the bottom of their cabinet frame shall provide an additional 12" of height to their stand or support structure to provide equal protection from elements as Mitsubishi Electric basis of design. Any additional support costs, equipment fencing, and tie downs required to meet this additional height shall be responsibility of Mechanical Contractor to provide.

c. The outdoor heat exchanger shall be of zinc coated aluminum construction with turbulating flat tube construction. The coil fins shall have a factory applied corrosion resistant finish. Uncoated aluminum coils/fins are not allowed.

d. The coil shall be protected with an integral metal guard.

e. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.

f. Unit shall have prewired plugs for optional panel heaters in order to prevent any residual ice buildup from defrost. Panel heaters are recommended for operating environments where the ambient temperature is expected to stay below -1°F for 72 hours.

g. Condenser coil shall have active hot gas circuit direct from compressor discharge on lowest coil face area to shed defrost condensate away from coil and protect from Ice formation after returning to standard heat pump operation. While in Heat Pump operation this lower section of the Outdoor Evaporator coil shall continually run hot gas from the compressor discharge to protect the coil from ice buildup and coil rupture. Manufacturers who do not have an active hot gas circuit in the lower section of the Outdoor coil to protect coil from freezing shall not be allowed to bid on project in markets where the outdoor unit will see temperatures below freezing.

20. Compressor:

a. Each outdoor unit module shall be equipped with only inverter driven scroll hermetic compressors. Non-inverter-driven compressors shall not be allowed.

b. Each compressor shall be equipped with a multi-port discharge mechanism to eliminate over compression at part load. Manufacturer's that rely on a single compressor discharge port and provide no means of eliminating over compression and energy waste at part load shall not be allowed.

c. Crankcase heat shall be provided via induction-type heater utilizing eddy currents from motor windings. "Belly-band" type crankcase heaters are not allowed. Manufacturers that utilize belly-band crankcase heaters will be considered as alternate only.

d. Compressor shall have an inverter to modulate capacity. The capacity for each compressor shall be variable with a minimum turndown not greater than 15%.

e. The compressor shall be equipped with an internal thermal overload.

f. Field-installed oil equalization lines between modules are not allowed. Prior to bidding, manufacturers requiring equalization must submit oil line sizing calculations specific to each system and module placement for this project.

g. Manufacturers that utilize a compressor sump oil sensor to equalize compressor oil volume within a single module shall not be allowed unless they actively shut down the system to protect from compressor failure.

21. Controls:

a. Outdoor unit shall include Variable Evaporator Temperature or comparable method of varying system evaporator (refrigerant) temperature in order to reduce compression ratio and power consumption during light load or mild ambient temperatures. Multiple evaporator refrigerant temperature settings shall be required in order to optimize efficiency within required system-specific performance and installation constraints. System shall reduce compression ratio only when/if all indoor units are within 1.8F of setpoint; reducing compression ratio based solely on ambient temperature risks discomfort and is not allowed. Variable Evaporator Temperature or comparable method shall incorporate override or disable capability based on external signal to allow for space humidity control or load demand. The unit shall be an integral part of the system & control network described in this section and react to heating/cooling demand as communicated from connected indoor units over the control circuit. Required field-installed control voltage transformers and/or signal boosters shall be provided by the manufacturer.

b. Each outdoor unit module shall have the capability of 4 levels of demand control based on external input.

22. Electrical:

a. The outdoor unit electrical power shall be 208/230 volts, 3-phase, 60 hertz per equipment schedule.

b. The outdoor unit shall be controlled by integral microprocessors.

c. The control circuit between the indoor units, BC Controller and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

C. Branch Circuit Controller(s)

1. Branch Circuit (BC) Controllers (or comparable branch devices) shall include multiple branches to allow simultaneous heating and cooling by allowing either hot gas refrigerant to flow to indoor unit(s) for heating or subcooled liquid refrigerant to flow to indoor unit(s) for cooling. Refrigerant used for cooling must always be subcooled for optimal indoor unit LEV performance; alternate branch devices which do not include controlled refrigerant subcooling are not allowed.

2. BC Controllers (or comparable branch devices) shall be equipped with a circuit board that interfaces to the controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish and be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors, with access and service clearance provided for each controller. BC Controllers (or comparable branch devices) shall be suitable for use in plenums in accordance with UL1995 ed 4.

3. BC Unit Cabinet:

a. The casing shall be fabricated of galvanized steel.

b. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.

c. The unit shall house two tube-in-tube heat exchangers.

4. Refrigerant Piping (specifications in addition to those for outdoor unit):

a. All refrigerant pipe connections shall be brazed.

b. Future changes to indoor unit quantities or sizes served by BC Controller or comparable branch device must be possible with no piping changes except between the branch device and indoor unit(s) changing. Systems which might require future piping changes between branch device and outdoor unit—if changes to indoor unit quantities or sizes are made—are not allowed.

5. Refrigerant valves:

a. Service shut-off valves shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation.

6. Condensate Management:

a. BC Controller (or comparable branch device) must have integral resin drain pan or insulate refrigeration components.

7. Electrical:

a. The unit electrical power shall be 208/230 volts, 1 phase, 60 Hertz. The unit shall be capable of satisfactory operation within voltage limits of 187-228 (208V/60Hz) or 207-253 (230/60Hz).

b. The BC Controller shall be controlled by integral microprocessors

c. The control circuit between the indoor units and outdoor units shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

D. Wall Mounted Indoor Fan Coil Units

1. The wall-mounted indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

2. Unit Cabinet:

a. All casings, regardless of model size, shall have the same white finish

b. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining are required.

c. There shall be a separate back plate which secures the unit firmly to the wall.

3. Fan:

a. The indoor fan shall be statically and dynamically balanced to run on a single motor with permanently lubricated bearings.

b. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).

c. A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.

4. Filter:

a. Return air shall be filtered by means of an easily removable, washable filter.

5. Coil:

a. Basis of design indoor units include factory-installed LEV/EEV. Alternative brands which require field-installed, accessory LEV or EEV kits are permissible only with written Engineer and Architect approval for the location of kits being submitted two weeks prior to bid date. EEV kits mounted in cavities inside fire-rated interior walls shall be mounted inside three hour fire rated enclosures with access panels supplied by the manufacturer. Enclosure type and placement require prior approval.

b. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos-copper or silver alloy.

c. The coils shall be pressure tested at the factory.

6. Electrical:

a. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.

b. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz)

7. Controls:

a. The unit shall include an IR receiver for wireless remote-control flexibility

b. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.

c. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable dead-band from set point.

d. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.

e. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

E. Multi-position Ducted Fan Coil Unit

1. The multi-position indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air

before shipment from the factory. The unit shall be suitable for use in air handling spaces in accordance with Section 18.2 of UL 1995 4th Edition, be tested in accordance with ANSI/ASHRAE 193 and have less than 2% air leakage at maximum airflow setting.

2. Unit Cabinet:

   a. The cabinet shall include a fixed bottom return, a fixed vertical discharge supply and be pre-painted, pre-insulated, 22-gauge galvanized steel.

3. Fan:

   a. The indoor unit fan shall be an assembly with a single, statically and dynamically balanced direct drive fan with a high efficiency DC motor with permanently lubricated bearings.

   b. The fan shall have 3-speeds with the capability to operate between 0.3-0.8 In.WG selectable.

4. Filters:

   a. The unit shall have an integral 1” filter rack with a reusable filter.

   b. Each unit shall be provided with pre-fabricated (or field fabricated) supplementary, duct mounted filter housing suitable for two (2) replaceable, 2” pleated filters. Pre-filter shall be MERV 8 rated and final filter shall be MERV 13 rated. Filter housing dimensions to suit, and shall be no less than the unit return connection opening. Contractor shall install new filters after final cleaning and prior to space turn-over.

5. Coil:

   a. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phos-copper or silver alloy. The coils shall be pressure tested at the factory.

6. Electrical:

   a. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.

   b. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

7. Controls:

   a. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F dead-band from set point.

b. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable dead-band from set point.

c. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.

d. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

F. Automatic Controls and Components

1. The control system shall consist of a low voltage communication network and a web-based interface. The controls system shall gather data and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.

2. Furnish energy conservation features such as optimal start, request-based logic, and demand level adjustment of overall system capacity as specified in the sequence.

3. System shall be capable of email generation for remote alarm annunciation.

4. Electrical Characteristics:

a. Controller power and communications shall be via a common non-polar communications bus and shall operate at 30VDC.

b. Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit, to the BC controller (main and subs, if applicable) and to the outdoor unit. Control wiring to remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.

c. Control wiring for centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit, to the system controllers (centralized controllers and/or integrated web based interface), to the power supply.

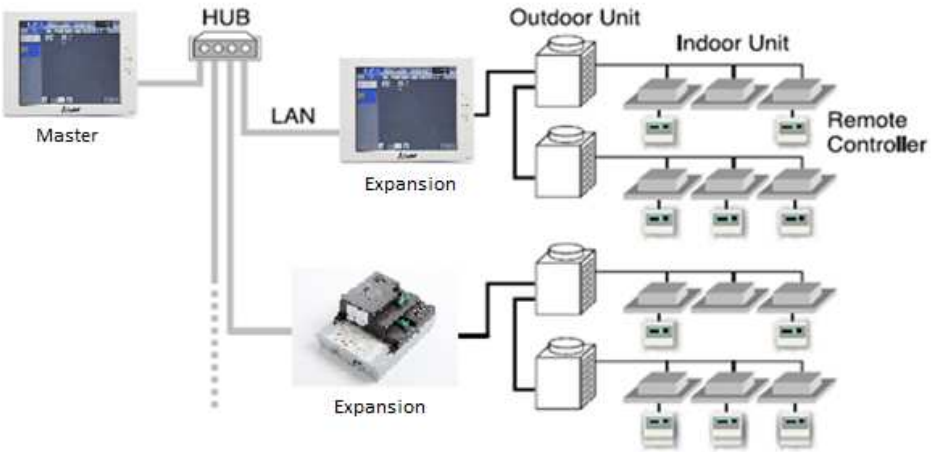
d. Wiring shall be 2-conductor (16 AWG), twisted, stranded, shielded wire as defined by the Diamond System Builder output.

e. Network wiring shall be CAT-5 with RJ-45 connection.

5. City Multi Controls Network:

a. The City Multi Controls Network (CMCN) consists of remote controllers, centralized controllers, and/or integrated web-based interface communicating over a high-speed communication bus. The City Multi Controls Network shall support operation monitoring, scheduling,

occupancy, error email distribution, personal web browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using either LonWorks® or BACnet® interfaces. The below figure illustrates a sample CMCN System Configuration.



1) CMCN System Configuration

6. Graphical User Interface:

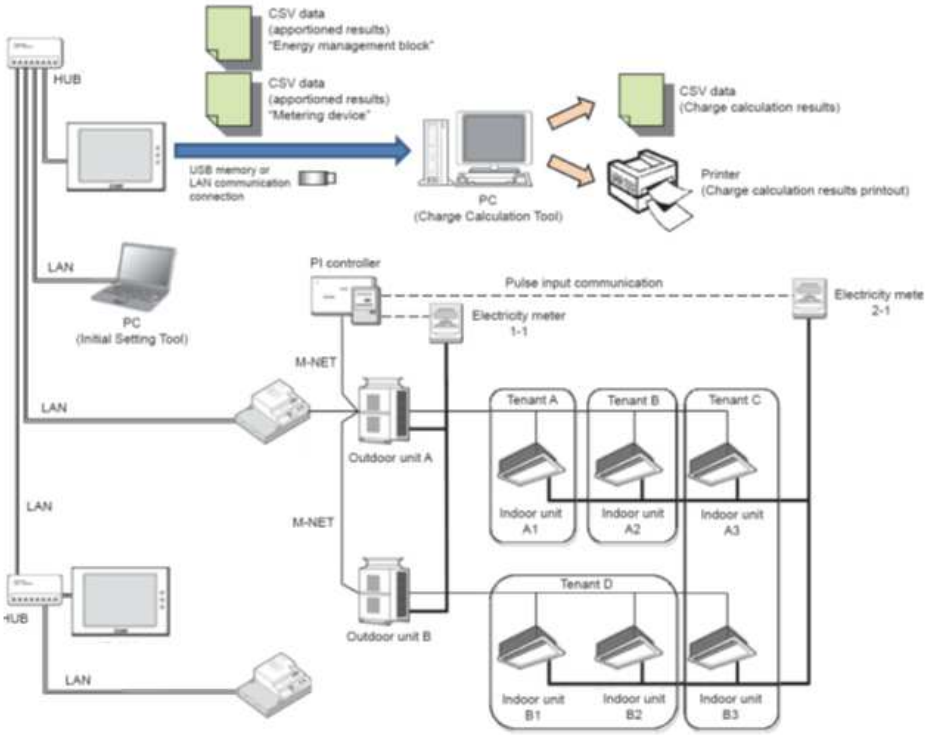
a. The Graphical User Interface (Integrated Centralized Control Web) shall require a field supplied PC or Tablet.

b. The Integrated Centralized Control Web System (ICCW) interface shall enable the user to control multiple networked central controllers and shall provide additional functions such as energy apportionment from a single network PC configured with the Charge Calculation Tool. The ICCW shall be capable of controlling up to forty networked Centralized Controllers with a maximum of 2,000 indoor units across multiple CITY MULTI outdoor units. The ICCW shall be required if the user wants to simultaneously control more than 1 Centralized Controllers from a single PC or tablet using a single web browser session. Licensing per function, per Centralized Controller shall be required for the ICCW. Optional software features shall be available through the ICCW including energy apportionment and personalized web. These optional software features shall require the ICCW, advance purchase from the customer, and licensing from ICCW.

ICCW (Integrated System Software)	
Item	Details
ON/OFF	The units can turn ON and OFF for all floors or in a block, floor, or group of units.
Operation Modes	The operation mode can be switched between COOL, DRY, FAN, AUTO, and HEAT for all floors or in a block, floor, or group of units
Temperature Setting	Sets the temperature for a single group. Range of Temperature setting from 57°F – 87°F depending on operation mode and indoor unit model. Separate COOL and HEAT mode set points available depending on remote controller and connected mechanical equipment.
Fan Speed	The fan speed can be set to four stages for all floors or in a block, floor, or group of units
Air Direction	The air direction can be set in four vertical directions or to swing for all floors or in block, floor, or group of units. (The selectable air direction differs according to the model.)
Interlocked Unit ON/OFF LOSSNAY	If there is an interlocked unit (LOSSNAY), then the unit can be turned ON (strong/weak) or OFF for all floors or in a block, floor, or group of units. (Note that the ventilation mode cannot be selected for interlocked units.)
Local Operation Prohibit	The items for which operation with the local remote controller are to be prohibited can be selected for all floors or in a block, floor, or group of units. (The items that can be prohibited are ON/OFF, operation mode, set temperature and filter sign reset.)
Annual /Weekly Schedule	The annual/weekly schedule function can be used by registering the license. Two settings, such as seasonal settings for summer and winter, can be saved.
Power Rate Apportionmen t Charging	A watt-hour meter (WHM) with kWH pulse output is connected to calculate the air conditioning charges based on the amount each tenant's air-conditioner has operated. Five charging rates can be applied per day. ***OPTIONAL ENERGY APPORTIONMENT SOFTWARE (LIC-CHARGE) and PI Controller (PAC-Y60MCA) REQUIRED
History	Up to 3,000 items for the error history and up to 10,000 items for operation history can be saved. Each history file can be output as a daily report or monthly report in CSV format. (The operation history consists only of the operations carried out with the ICCW and is limited to some limited operation items.)
Operation Time Monitor	The cumulative operation time of each indoor unit can be viewed or output as a CSV format file. (This function is valid only when the charging function license is registered.)
Filter Sign Display Mask	The filter sign display at the remote controllers can be disabled.
Set Temperature Limit	The set temperature lower limit can be set for cooling and the upper limit for heating. (ME remote controller required)

7. CMCN System Integration - The CMCN shall be capable of supporting integration with Building Management Systems (BMS) via industry standard communication protocols including BACnet and LonWorks®.

8. Energy Appointment Method For City Multi Centralized Controllers



a. CMCN System Configuration

b. For centralized systems serving multiple tenants for which one-to-one electricity metering is not possible, an apportioned electricity billing function that attributes just the electrical energy consumed by each individual tenant's air conditioner is required. The Energy Apportionment function takes the information on the electrical energy usage gathered from Watt Hour Meters (WHM) connected to dedicated breaker panels serving the system's outdoor units and synthesizes it with the information on the operating status of the indoor units that is collected by the City Multi centralized controller(s).

c. The Watt Hour Meters (WHMs) to be used to read the electrical energy consumption of the outdoor units must be capable of a pulse output, which would be configured based on the current rating of the units. The associated current transformers/ transducers (CTs) must also be sized based on the current rating of either the individual outdoor units or the dedicated air conditioning electrical panels they are to be reading. The proper quantity of meters for a particular sized system must be selected in order to ensure sufficient resolution and hysteresis in the unit pulse output of the meters so as to ascribe an acceptable level of accuracy to the apportionment of energy

usage for each tenant's system. The system is designed to work with any WHM capable of a pulse output that meets ANSI C12.20 class 0.2% or 0.5% accuracy standards.

d. The WHMs are to be physically connected to the integrated pulse input module or an external Mitsubishi Electric PI Controller if such an input is not available or if there is a wiring length limitation or installation hardship. The cable type of the interconnecting wiring shall be according to the wiring specifications of the WHM manufacturer.

e. City Multi Centralized Controller Requirements:

1) Each centralized controller to which units are assigned that require the energy apportionment function must have the "LIC-Charge" software license purchased and properly unlocked in order to enable the operating status of the indoor units to be passed to the energy apportionment tool. The procedure for licensing the centralized controllers with this function and the necessary forms can be found on Mitsubishi Electric's technical documentation repository, mylinkdrive.com. Purchase Order information for the licenses will be required at the time of submission of the licensing request forms.

2) A dedicated master centralized controller for apportionment (no MNET connection), for which the LIC-Charge license is purchased and the energy apportionment function enabled, must be provided in order to serve as the portal for exporting metering device and energy management data to a USB drive or to a PC via LAN connection. This means that by virtue of selecting this master centralized controller to serve this function, the MNET capability of this particular centralized controller will be disabled. All indoor units must be physically wired via MNET to other expansion centralized controllers, which must be physically wired via LAN with Static IP addresses and a network hub or switch to the master apportionment controller.

3) A networked PC for collecting charge calculation results (which does not necessarily have to be dedicated to the task of collecting energy apportionment data) can be provided and loaded with the Charge Calculation Tool software for exporting data necessary to generate billing documentation to be performed by a third party. The system requirements of the PC are as follows:

Item	Requirements
CPU	1 GHz or better (at least 2 GHz recommended)
Memory	2GB or more
Screen Resolution	1024 x 768 or better
OS	Windows 7, Windows 8.1 (32bit/64bit)
System requirements	The system should meet the minimum requirement for Windows 7 or Windows 8.1, Net Framework 4.5 or later

Internal LAN port or LAN card	100 BASE-TX or better
Porting device	Mouse, etc.

9. CMCN: Remote Controllers

   a. Simple MA Remote Controller - The Backlit Simple MA Remote Controller shall be capable of controlling up to 16 indoor units (defined as 1 group). The Backlit Simple MA Remote Controller shall only be used in same group with Wireless MA Remote Controllers or with other Backlit Simple MA Remote Controllers, with up to two remote controllers per group.

Simple MA Remote Controller			
Item	**Description**	**Operation**	**Display**
ON/OFF	Run and stop operation for a single group	Each Group	Each Group
Operation Mode	Switches between Cool/Drying/Auto/Fan/Heat/Setback. Operation modes vary depending on the air conditioner unit. Auto and Setback mode are available for R2/WR2-Series only.	Each Group	Each Group
Temperature Setting	Sets the temperature from 40°F – 95°F depending on operation mode and indoor unit. Separate COOL and HEAT mode set points available depending on central controller and connected mechanical equipment.	Each Group	Each Group
Fan Speed Setting	Available fan speed settings depending on indoor unit.	Each Group	Each Group
Air Flow Direction Setting	Air flow direction settings vary depending on the indoor unit model.	Each Group	Each Group
Permit / Prohibit Local Operation	Individually prohibit operation of each local remote control function (Start/Stop, Change operation mode, Set temperature, Reset filter). *1: Centrally Controlled is displayed on the remote controller for prohibited functions.	N/A	Each Group *1
Display Indoor Unit Intake Temp	Measures and displays the intake temperature of the indoor unit when the indoor unit is operating.	N/A	Each Group
Display Backlight	Pressing the button lights up a backlight. The light automatically turns off after a certain period of time. (The brightness settings can be selected from Bright, Dark, and Light off.)	N/A	Each Unit
Error	When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed	N/A	Each Unit
Test Run	Operates air conditioner units in test run mode.	Each Group	Each

Simple MA Remote Controller			
Item	**Description**	**Operation**	**Display**
	*2 The display for test run mode will be the same as for normal start/stop (does not display "test run").		Group *2
Ventilation Equipment	Up to 16 indoor units can be connected to an interlocked system that has one LOSSNAY unit.	Each Group	N/A
Set Temperature Range Limit	Set temperature range limit for cooling, heating, or auto mode.	Each Group	Each Group

10. Centralized Controller (Web-Enabled)

    a. The Master Centralized Controller shall be capable of controlling a maximum of two hundred (200) indoor units across multiple City Multi outdoor units with the use of three expansion controllers. The Master Centralized Controller shall be approximately 11-5/32" x 7-55/64" x 2-17/32" in size and shall be powered with an integrated 100-240 VAC power supply. The Master Centralized Controller shall support system configuration, daily/weekly scheduling, monitoring of operation status, night setback settings, free contact interlock configuration and malfunction monitoring. When being used alone without the expansion controllers, the Master Centralized Controller shall have five basic operation controls which can be applied to an individual indoor unit, a collection of indoor units (up to 50 indoor units), or all indoor units (collective batch operation). This basic set of operation controls for the Master Centralized Controller shall include on/off, operation mode selection (cool, heat, auto (R2/WR2-Series only), dry, setback (R2/WR2-Series only) and fan), temperature setting, fan speed setting, and airflow direction setting. Since the master provides centralized control it shall be able to enable or disable operation of local remote controllers. In terms of scheduling, the Master Centralized Controller shall allow the user to define both daily and weekly schedules (up to 24 scheduled events per day) with operations consisting of ON/OFF, mode selection, temperature setting, air flow (vane) direction, fan speed, and permit/prohibit of remote controllers.

G. All Master Centralized Controllers shall be equipped with two RJ-45 Ethernet ports to support interconnection with a network PC via a closed/direct Local Area Network (LAN) or to a network switch for IP communication to up to three expansion controllers for display of up to two hundred (200) indoor units on master centralized controller interface.

H. The Master Centralized Controller shall be capable of performing initial settings via the high-resolution, backlit, color touch panel on the controller or via a PC browser using the initial settings.

I. Standard software functions shall be available so that the building manager can securely log into each master centralized controller via the PC's web browser to support operation monitoring, scheduling, error email, interlocking and online maintenance diagnostics. Additional optional software functions of personal browser for PCs and MACs and

Energy shall be available but are not included. The Energy Apportionment function shall require a LIC-Charge software license

Master Centralized Controller			
Item	**Description**	**Operation**	**Display**
ON/OFF	Run and stop operation.	Each Block, Group or Collective	Each Group or Collective
Operation Mode	Switches between Cool/Dry/Auto/Fan/Heat. (Group of Lossnay unit: automatic ventilation/vent-heat/interchange/normal ventilation) Operation modes vary depending on the air conditioner unit. Auto mode is available for the R2/WR2-Series only.	Each Block, Group or Collective	Each Group
Temperature Setting	Sets the temperature from 57°F – 87°F depending on operation mode and indoor unit.	Each Block, Group or Collective	Each Group
Fan Speed Setting	Available fan speed settings depending on indoor unit.	Each Block, Group or Collective	Each Group
Air Flow Direction Setting	Air flow direction settings vary depending on the indoor unit model. *1. Louver cannot be set.	*1 Each Block, Group or Collective	Each Group
Schedule Operation	Annual/weekly/today schedule can be set for each group of air conditioning units. Optimized start setting is also available. The system follows either the current day, annual schedule, or weekly, which are in the descending order of overriding priority. Twenty-four events can scheduled per day, including ON/OFF, Mode, Temperature Setting, Air Direction, Fan Speed and Operation Prohibition. Five types of weekly schedule (seasonal) can be set. Settable items depend on the functions that a given air conditioning unit supports.	*2 Each Block, Group or Collective	Each Group
Optimized Start	Unit starts 5 - 60 minutes before the scheduled time based on the operation data history in order to reach the scheduled temperature at the scheduled time.	Each Block, Group or Collective	Each Block, Group or Collective
Night Setback Setting	The function helps keep the indoor temperature in the temperature range while the units are stopped and during the time this function is effective.	Each Group	Each Group
Permit / Prohibit	Individually prohibit operation of each local remote control function (Start/Stop, Change operation mode,	Each Block,	*3 Each Group

Master Centralized Controller			
Item	**Description**	**Operation**	**Display**
Local Operation	Set temperature, Reset filter). Centrally Controlled is displayed on the remote controller for prohibited functions.	Group or Collective	
Room Temp	Displays the room temperature of the group. Space temperature displayed on the indoor unit icon on the touch screen interface.	N/A	Each Group
Error	When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed When an error occurs, the LED flashes. The operation monitor screen shows the abnormal unit by flashing it. The error monitor screen shows the abnormal unit address, error code and source of detection. The error log monitor screen shows the time and date, the abnormal unit address, error code and source of detection	N/A	*4 Each Unit or Collective
Outdoor Unit Status	Compressor capacity percentage and system pressure (high and low) pressure (excludes S-Series)	Each ODU	Each ODU
Connected Unit Information	MNET addresses of all connected systems	Each IDU, ODU and BC	Each IDU, ODU and BC
Ventilation Equipment	This interlocked system settings can be performed by the master system controller. When setting the interlocked system, use the ventilation switch the free plan LOSSNAY settings between “Hi”, “Low” and “Stop”. When setting a group of only free plan LOSSNAY units, you can switch between “Normal ventilation”, “Interchange ventilation” and “Automatic ventilation”.	Each Group	Each Group
Multiple Language	Other than English, the following language can be chosen. Spanish, French, Japanese, Dutch, Italian, Russian, Chinese, and Portuguese are available.	N/A	Collective
External Input / Output	By using accessory cables you can set and monitor the following. Input By level: “Batch start/stop”, “Batch emergency stop” By pulse: “batch start/stop”, “Enable/disable remote controller” Output: “start/stop”, “error/Normal” Requires the external I/O cables (PAC-YG10HA-E) sold separately.	*5 Collective	*5 Collective

1. Expansion Controller - The Expansion Controller shall serve as a standalone centralized controller or as an expansion module to the Master Centralized Controller for the purpose of adding up to 50 indoor units to either the main touch screen interface of the master centralized controller. Up to three (3) expansion controllers can be connected to the master via a local IP network (and their IP addresses assigned on the master) to the master to allow for up to two hundred (200) indoor units to be monitored and controlled from the master interface.

J. The expansion controllers have all of the same capabilities to monitor and control their associated indoor units as the features specified above. Even when connected to the master and configured to display their units on the main controller, the individual indoor units connected to the expansion can still be monitored and controlled from the interface of the expansion. The last command entered will take precedence, whether at the wall controller, the expansion or the master Centralized Controller.

1. Non-Touch Screen, Networked Centralized Controller - The Non-Touch Screen, Networked Centralized Controller shall be capable of controlling a maximum of 50 indoor units across multiple CITY MULTI outdoor units. The controller shall be approximately 8-1/2”x10” in size and shall be powered by its internal power supply. The controller shall support system configuration, daily/weekly scheduling, monitoring of operation status, free contact interlock configuration and malfunction monitoring. The controller shall have five basic operation controls which can be applied to an individual indoor unit, a group of indoor units (up to 50 indoor units), or all indoor units (collective batch operation). This basic set of operation controls for the controller shall include on/off, operation mode selection (cool, heat, auto (R2/WR2-Series only), dry, temperature setting, fan speed setting, and airflow direction setting. Since the controller provides centralized control, it shall be able to enable or disable operation of local remote controllers. In terms of scheduling, the controller shall allow the user to define both daily and weekly schedules with operations consisting of ON/OFF, mode selection, temperature setting, air flow (vane) direction, fan speed, and permit/prohibit of remote controllers.

K. All Non-Touch Screen, Networked Centralized Controller shall be equipped with two RJ-45 Ethernet port to support interconnection with a network PC and BACnet/IP communication via a closed/direct Local Area Network (LAN). The controller shall be capable of performing initial settings online via a PC using the controller’s initial setting browser or online/offline with the Initial Setting Tool.

L. Standard software functions shall be available so that the building manager can securely log into each controller via the PC’s web browser to support operation monitoring, scheduling, error email, interlocking and online maintenance diagnostics. Standard software functions shall not expire. Additional optional software functions of personal browser for PCs and MACs and Energy Allocation shall be available. The Energy Allocation function shall require Master Centralized Controller Energy Allocation Integrated System in conjunction with Non-Touch Screen, Networked Centralized Controller.

Non-Touch Screen, Networked Centralized Controller			
Item	**Description**	**Operation**	**Display**

Non-Touch Screen, Networked Centralized Controller			
Item	**Description**	**Operation**	**Display**
ON/OFF	Run and stop operation.	Each Block, Group or Collective	Each Group or Collecti ve
Operation Mode	Indoor unit modes: COOL/DRY/FAN/AUTO/HEAT. Lossnay unit modes: HEAT RECOVERY/BYPASS/AUTO Air to water (PWFY) modes: HEATING/HEATING ECO/HOT WATER/ANTI-FREEZE/COOLING *Operation modes vary depending on the unit model connected. ** Auto mode is available for the R2/WR2-Series only.	Each Block, Group or Collective	Each Group
Temperature Setting	Sets the temperature from 40°F – 95°F depending on operation mode and indoor unit model. Separate COOL and HEAT mode set points available depending on remote controller and connected mechanical equipment.	Each Block, Group or Collective	Each Group
Set Temperature Range Limit	The range of room temperature setting can be limited by the initial setting depending on the indoor unit connected.	Each Group	Each Group
Fan Speed Setting	Available fan speed settings depend on indoor unit model.	Each Block, Group or Collective	Each Group
Air Flow Direction Setting	*Air flow direction settings vary depending on the indoor unit model. Louver cannot be set.	*1 Each Block, Group or Collective	Each Group
Schedule Operation	Annual/weekly/today schedule can be set for each group of air conditioning units. Optimized start setting is also available. *2. The system follows either the current day, annual schedule, or weekly, which are in the descending order of overriding priority. Twenty-four events can scheduled per day, including ON/OFF, Mode, Temperature Setting, Air Direction, Fan Speed and Operation Prohibition. Five types of weekly schedule (seasonal) can be set. Settable items depend on the functions that a given air conditioning unit supports.	*2 Each Block, Group or Collective	Each Group

Non-Touch Screen, Networked Centralized Controller			
Item	**Description**	**Operation**	**Display**
Hold	Disables scheduled functions for indoor unit groups and their associated remote controller timers. *not available for general equipment	Each Block, Group or Collective	Each Group
Optimized Start	Unit starts 5 - 60 minutes before the scheduled time based on the operation data history in order to reach the scheduled temperature at the scheduled time.	Each Block, Group or Collective	Each Block, Group or Collecti ve
Permit / Prohibit Local Operation	Individually prohibit operation of each local remote control function (Start/Stop, Change operation mode, Set temperature, Fan Speed, Air Direction and Reset filter). Centrally Controlled is displayed on the remote controller for prohibited functions.	Each Block, Group or Collective	*3 Each Group
Room Temp	Displays the room temperature of the group.	N/A	Each Group
Room Humidity	Displays the percent relative humidity in the space as sensed by the Smart ME Remote Controller	N/A	Each Group
Occupancy Sensor	Displays the occupancy icon on the group icon in the condition list page when the room is occupied (blue) or vacant (gray). *The Smart ME Remote Controller Occupancy sensor is required.	N/A	Each Group
Brightness Sensor	Displays the brightness icon on the group icon in the condition list when the space is determined to be bright (yellow) or dark (gray). *The Smart ME Remote Controller Brightness sensor is required.	N/A	Each Group
Error	When an error is currently occurring on an air conditioner unit, the afflicted unit and the error code are displayed When an error occurs, the LED flashes. The operation monitor screen shows the abnormal unit by flashing it. The error monitor screen shows the abnormal unit address, error code and source of detection. The error log monitor screen shows the time and date, the abnormal unit address, error code and source of detection	N/A	*4 Each Unit or Collecti ve
Ventilation Equipment	This interlocked system settings can be performed by the master system controller. When setting the interlocked system, use the ventilation switch the free plan LOSSNAY settings between “Hi”, “Low” and “Stop”. When setting a group of only free plan	Each Group	Each Group

Non-Touch Screen, Networked Centralized Controller			
Item	**Description**	**Operation**	**Display**
	LOSSNAY units, you can switch between "Normal ventilation", "Interchange ventilation" and "Automatic ventilation".		
Multiple Language	Other than English, the following language can be chosen. Spanish, French, Japanese, German, Italian, Russian, Chinese, and Portuguese are available.	N/A	N/A
External Input / Output	By using accessory cables you can set and monitor the following. Input: By level: "Batch start/stop", "Batch emergency stop"; By pulse: "batch start/stop", "Enable/disable remote controller" Output: "start/stop", "error/Normal" Requires the external I/O cables (PAC-YG10HA-E) sold separately.	*5 Collective	*5 Collecti ve
M-Net	The "M-NET" LED lights, when AC power supply is turned ON. The LED blinks while M-NET is communicating.	N/A	Each Group (LED)
Collective ON/OFF	All the units can be operated / stopped with a DIP switch.	Collective	N/A
Measurement	Displays the Temperature and Humidity inputs of the AI Board. Supports graph display and data export.	N/A	Each Unit
AHC Status	Displays the status of the of the inputs and outputs of each Advanced HVAC Controller (DC-A2IO)	N/A	Each Unit
Free Contact Status	Displays the input/output status of the Free Contacts on the indoor units	N/A	Each Unit
Free Contact Interlock Control	Operation of indoor groups, general equipment or free contact outputs based on group(s) conditions or free contact(s) input states.	Each Group, Output or Collective	N/A
Data Back-up (PC)	Initial setting data can be exported to a PC.	Collective	N/A

1. CMCN Remote Controllers: System Integration

   a. The CMCN shall be capable of supporting integration with Building Management Systems (BMS).

   b. BACnet® Integration - The Mitsubishi Electric Cooling & Heating BACnet® hardware, which is built into all networked central controllers, shall be compliant with BACnet® Protocol (ANSI/ASHRAE 135-2010) and be Certified by the (BTL) BACnet® Testing Laboratories. The BACnet® interface shall support BACnet Broadcast Management (BBMD). The BACnet® interface shall support a maximum of 50 indoor units. Operation and monitoring points include, but are not limited to, on/off, operation

mode, fan speed, prohibit remote controller, filter sign reset, alarm state, error code, and error address.

c. Licenses:

1) LIC-BACnet Master: Master Controller license for Master Centralized Controller and Non Touch Screen, Networked Centralized Controller

2) LIC-BACnet Expansion: Expansion Controller license for Expansion Controller and Non Touch Screen, Networked Centralized Controller

d. LIC-BACnet Specifications:

1) Control up to 50 groups

2) 1 to 16 indoor units can be collectively controlled in a group

3) Supports dual set point functionality (connected model dependent)

4) BTL Compliant

5) BACnet communication specifications are based on ANSI/ASHRAE Standards 135-2010

e. PC Requirements:

1) CPU: 1GHz or higher

2) Memory: 1GB or more

3) HDD Space: 100 MB or more

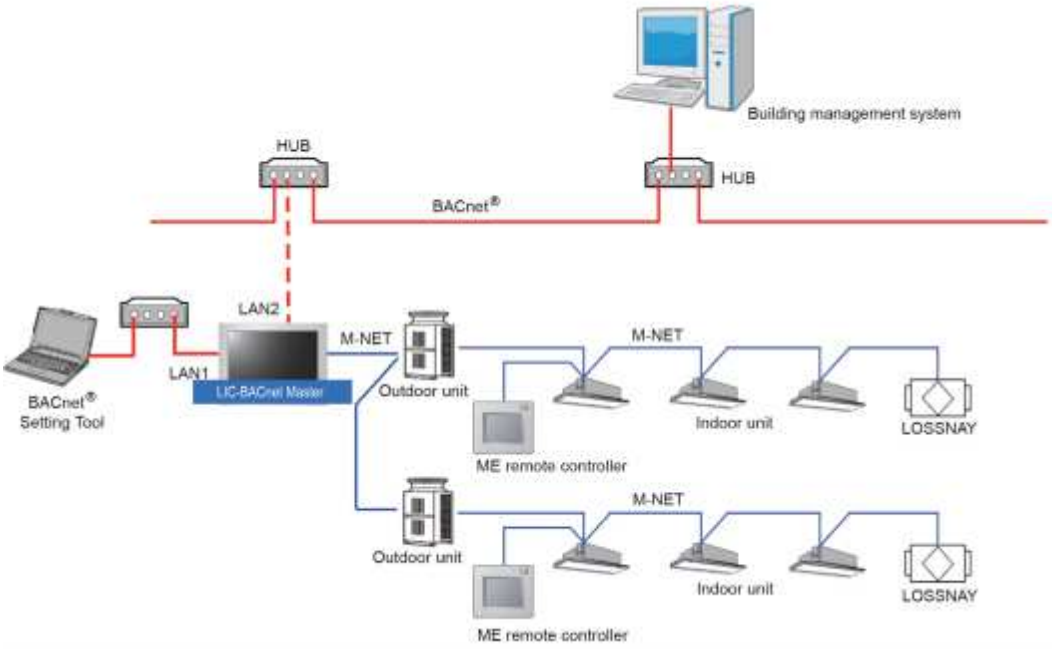
4) Screen Resolution: 1024 x 768 or higher

5) OS: Microsoft Windows 7 32-bit/64-bit, Microsoft 8.1 32-bit/64-bit. Not compatible with Windows Vista

6) Execution Environment: Microsoft .NET Framework 4.5 or later

7) Others: Pointing device such as a mouse, internet connection (required when installing a .NET Framework)

f. LIC-BACnet – System Example



g. BACnet Point List

Object List
On Off Setup
On Off State, Number of ON/OFF, Cumulative operation time
Alarm Signal (4-digit error code)
Error Code
Operational Mode Setup
Operational Mode State
Fan Speed Setup
Fan Speed State
Room Temp
Set Temp
Set Temp Cool
Set Temp Heat
Set Temp Auto
Filter Sign
Filter Sign Reset
Prohibition On Off
Prohibition Mode
Prohibition Filter Sign Reset
Prohibition Set Temperature
M-NET Communication State
System Forced Off
Air Direction Setup
Air Direction State
Set High Limit Setback Temp
Set Low Limit Setback Temp

Ventilation Mode Setup
Ventilation Mode State
Air To Water Mode Setup
System Alarm Signal (4-digit error code)
PI Controller Alarm Signal (4-digit error code)
Group Apportioned Electric Energy
Interlocked Units Apportioned Electric Energy
PI controller Electric Energy 1–4
Pulse Input Electric Energy 1–4
Group Apportionment Parameter
Interlocked Units Apportionment Parameter
Night Purge State
Thermo On Off State
Trend Log Room Temp
Trend Log Group Apportioned Electric Energy
Trend Log Interlocked Units Apportioned Electric Energy
Trend Log PI controller Electric Energy 1–4
Trend Log Pulse Input Electric Energy 1–4
Trend Log Group Apportionment Parameter
Trend Log Interlocked Units Apportionment Parameter

2.09 SHEET METAL DUCTWORK

A. Furnish all sheet metal work and accessories specified herein.

B. References to "Duct Manual" herein refer to the First Edition- 1995 - HVAC Duct Construction Standards as published by the Sheet Metal and Air Conditioning Contractor National Association, Inc.

C. All ducts shall be of galvanized steel construction. Ducts shall be properly stiffened to prevent drumming when the fans are in operation.

D. All galvanized duct thicknesses shall be as follows:

1. Longest duct dimension up to 12" - 26 gauge

2. Longest duct dimension 13" through 24" - 24 gauge

3. Longest duct dimension 25" through 30" - 22 gauge

4. Longest duct dimension over 31" - 20 gauge

E. Seal all low pressure duct joints (Class B) and medium pressure ducts (Class A) with sealant as manufactured by Minnesota Mining Company, Foster, General Electric, or approved equal. Excess sealant must be removed immediately to provide a neat appearance.

F. All low pressure ducts shall be fabricated for 2 inches water gauge pressure. Low pressure ducts shall include all ductwork except ductwork between roof top units and variable air volume box. Ductwork between air roof top units and fan powered mixing boxes/variable air volume terminal units in variable air volume systems shall be medium pressure duct fabricated for 4 inches water gauge pressure.

G. All ducts shall be constructed in accordance with Table 1 and Figure 1-5 through 1-13 of the Duct Manual.

H. Duct joints shall be constructed in accordance with Fig. 1-4 of the Duct Manual.

I. Duct seams shall be constructed in accordance with Fig. 1-5 of the Duct Manual.

J. Duct reinforcement shall be per Table 1-18, Figures 1-9, 1-10 and 1-11 of the Duct Manual.

K. Fittings and special installations shall be constructed in accordance with Figure 2-1 through 2-10 of the Duct Manual.

L. Register and grille connections shall be in accordance with Figure 2-16 of the Duct Manual.

M. Flexible connections shall be 4" wide connections, in accordance with Fig. 2-19 of the Duct Manual, constructed of Ventglass heavy glass fabric double coated with neoprene and shall be as manufactured by Vent Fabrics, Inc. Flexible connections shall meet the requirements of the National Board of Fire Underwriters. Exterior flexible connection shall be weathertight.

N. Hangers and supporting systems shall be in accordance with Figure 4-1 through 4-8 and Tables 4-1 through 4-3 of the Duct Manual.

2.10 DUCTWORK ACCESSORIES

A. Manual Volume Dampers

1. Manual volume dampers shall be provided where shown on the Drawings at every branch take off from the main duct, and elsewhere as required by the Balancing Contractor, and shall be single or multiple blade type with sleeve bearings, galvanized steel interlocking blades and a galvanized steel frame. In ducts over 15" deep provide multiple opposed blade type, gang operated dampers with a maximum blade width of 8". Damper blades shall be fabricated of 16 gauge steel with hemmed edges, and a maximum length of 48". Damper operating rod shall be full blade length extended through the duct to externally mounted bearing plates. On insulated ductwork, bearing plates shall be installed flush with insulation finish and fastened to the duct. Operating lever shall be of the indicating type with locking quadrant.

B. Barometric Dampers

1. Barometric back draft dampers shall be provided where indicated and required, and shall consist of a set of adjustable counter weighted louvers that open automatically due to excess pressure. The edges of the blades shall be provided with felt strips to prevent rattling and air leakage. The damper blades shall be supported on metal frames designed for wall mounting as indicated. The dampers shall be standard catalog products of Air Balance, Inc., Penn Ventilator, E. Van Noorden Company or approved equal.

C. Fire Dampers

1. Provide fire dampers at all fire walls and floors, where required by Code and as indicated. Fire damper construction and installation shall meet the requirements of the NFPA 90A, and shall be UL labeled, tested and inspected in accordance with UL 555. Fire dampers shall be as manufactured by Air Balance, Inc., Penn Ventilator Company, Ruskin or approved equal.

2. An access door shall be provided at each damper to service and inspect the fusible link.

3. Ducts shall be enlarged where fire dampers are installed to maintain the same free area through the damper as in the duct run. Provide all required sleeves, angles, and connectors as detailed on the Drawings.

D. Combination Fire Smoke Dampers

1. Combination fire smoke dampers shall be furnished and installed at the locations shown on the plans and shall meet or exceed the following criteria:

   a. Requirements of NFPA90A, 92A and 92B

   b. 3-hour fire rating in accordance with UL 555

   c. Classified as Leakage Class I Smoke Damper in accordance with UL 555S

   d. AMCA licensed and rated for air performance

   e. Minimum temperature rating of 250°F or 350° for dampers and actuators in accordance with UL 555S

2. Each fire smoke damper shall be equipped with a "controlled closure" quick detect heat-actuated release device. Instantaneous damper closure through the use of fusible links is unacceptable.

3. Damper frame shall be constructed of a roll-formed structural hat channel, reinforced at the corners, formed from a single piece of minimum 16 gage (1.6) galvanized steel.

4. Damper blades shall be airfoil shaped with 13 gage (2.3) equivalent thickness formed from a single piece of galvanized steel.

5. Bearings shall be stainless steel turning in an extruded hole in the frame.

6. Blade edge seals shall be silicone rubber and galvanized steel mechanically locked in to the blade edge (adhesive type seals are not acceptable).

7. Each damper shall be supplied with a factory mounted sleeve of 17" (432) minimum

E. Volume Extractors

1. Shall be manufactured by the drum louver or supply air register manufacturer of all aluminum construction. Position adjustment operator shall be key-operated screw with access through face of register. Extractor blades shall be spaced 1" on center.

F. Blank-off Plates

1. Any blank-off plates or conversions required for mounting control dampers or coils shall be the responsibility of the Sheet Metal Sub subcontractor.

G. Insulated Metal Panels

1. Provide 18-gauge, insulated double wall sandwich construction, 1½" thick where called for on the Drawings and for blanking off unused portions of wall louvers.

H. Access Doors

1. In ductwork up to 2" pressure class.

a. Frame: 24-gauge galvanized steel with seal

b. Door: hinged, with 24-gauge galvanized steel exterior and interior panels.

c. Locks: doors 16" and under, one lock doors over 16", two locks

d. Seals: foam gasket

I. Radiation Dampers

1. Radiation Dampers: Radiation damper construction and installation shall meet the requirements of the NFPA 90A, and shall be UL labeled, tested and inspected in accordance with UL 555.

2. Provide radiation dampers in each apartment unit where the supply and return air registers penetrates the ceiling/floor assembly.

2.11 INSULATION

A. Furnish all insulation required for the air-conditioning system, including:

1. Pipe insulation for:

a. Refrigerant liquid (RLL) and refrigerant suction (RLS) piping, including fittings, valves, strainers, etc.

b. Condensate Drain piping, including fittings, etc.

2. Duct insulation for:

a. All supply, return and fresh air ductwork

b. Exhaust ductwork in unheated spaces

c. Requirements for Grease Exhaust duct insulation are indicated on plans

B. Insulation shall be Owens-Corning, Knauf, Certainteed, or approved equal.

C. Refrigerant Pipe: For all refrigerant piping provide closed cell elastomeric insulation with heat transfer not to exceed 0.27 BTU/hr/ft2/°F/inch. Insulation wall thickness shall comply with the International Energy Conservation Code and as noted on "Pipe Insulation Table" in the Contract Drawings.

D. All exterior refrigerant piping and specialties shall be provided with a field-applied or pre-applied protective finishing and/or vapor sealing, operating within the temperature range of -94°F (-70°C) and 300°F (149°C).

1. Piping shall be sheathed with a laminated, flexible, self-adhering, protective jacketing, vapor barrier and weather proofing membrane, having a high performance acrylic adhesive capable of installation with no additional mechanical attachment.

2. Jacketing material shall be Venture-clad 1577CW (5-ply) natural, white (white membrane), or approved equal with finish coordinated through architect. The jacketing material shall have a maximum flame spread/smoke developed index of 10/20 per UL 723 test, a 0.000 water vapor permeance rating per ASTM E-96, and mold inhibitors incorporated. All products shall be UV stable.

3. Product fabrication and installation shall conform to the manufacturer's installation instructions and Midwest Insulation Contractors Association National Insulation Standards Manual. If there is conflicting information, manufacturer's installation instructions shall take precedence.

E. Insulate all condensate piping with minimum 3/4" thick closed cell elastomeric foam pipe insulation. Provide with Line-Hide or similar concealment when installed exposed within the building. Insulation shall be as manufactured by Armacell, Aeroflex, K-flex or approved equal.

F. Exterior pipe insulation shall be weatherproofed with Childers, Monville, Ferro Corp., or approved equal, aluminum jacketing. The jacketing shall be manufactured from T/3003 aluminum and shall have a factory attached moisture barrier continuously laminated across the full width of the jacketing. Jacket thickness shall be 0.016 inch.

G. Insulate all supply, return and outdoor air ductwork (within building) with minimum 2″ thick, 3/4 lb. density fiberglass duct insulation, ASTM C533, maximum service

temperature 450°F, with factory applied flame retardant FSK or PSK facing (UL labeled). Insulation shall have minimum R-value of 6.

H. In general, exhaust air ducts shall not be insulated when located within heated/conditioned spaces. Exhaust louvers and sections of duct in unconditioned/unheated spaces and prior to the motorized or gravity operated damper shall be insulated with 2″ thick, 3/4 lb. density fiberglass duct insulation, ASTM C533, maximum service temperature 450°F, with factory applied flame retardant FSK or PSK facing (UL labeled). Insulation shall have minimum 'R'-value of 6.

I. Interior Ductwork located within unconditioned space or as noted: Insulate the ductwork with minimum 3 inch thick, ¾ lb. density fiberglass duct insulation, ASTM C533, maximum service temperature 450°F, with factory applied flame retardant PSK facing (UL labeled). Insulation shall have a minimum installed 'R'-value of 8.

J. Exterior Ductwork: Ductwork to be installed outdoors shall be insulated with 3″ thick, 1.5 lb. Density polyolefin foam insulation. Joints to be sealed per manufacture's recommendation. Insulation shall then be wrapped with rubberized asphalt/10 mil polyethylene film membrane. Insulation shall have a minimum 'R'-value of 12.

K. PVC jackets shall meet ASTM D1784, Class 14253-C have a flame spread of 25 or less, have a smoke developed rating of 50 or less. PVC jackets shall be joined and sealed by applying continuous PVC cement along all seams.

L. Fiberglass Insulation

1. Fiberglass shall meet ASTMC 335 for thermal efficiency.

2. Ends of insulation shall be sealed with material as recommended by the manufacturer.

3. A complete moisture and vapor seal shall be provided wherever insulation terminates against metal hangers, anchors and other projections through insulation on cold surfaces.

4. Fire Hazard Rating: Insulation materials, coatings and other accessories shall individually have a fire hazard rating not to exceed 25 for flame spread and 50 for fuel contributed and smoke developed. Ratings shall be determined by U.L. "Test Method for Fire Hazard Classification of Building Materials", No. 823 or NFPA No. 225 or ASTM E84.

M. Elastomeric Foam Insulation

1. Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Grade 1, Type I for tubular materials.

2. Ends of insulation shall be sealed with material as recommended by the manufacturer.

3. A complete moisture and vapor seal shall be provided wherever insulation terminates against metal hangers, anchors and other projections through insulation on cold surfaces.

4. Fire Hazard Rating: Insulation materials, coatings and other accessories shall individually have a fire hazard rating not to exceed 25 for flame spread and 50 for fuel contributed and smoke developed. Ratings shall be determined by U.L. "Test Method for Fire Hazard Classification of Building Materials", No. 823 or NFPA No. 225 or ASTM E84.

N. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.

1. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper

2. Factory-Fabricated Fitting Covers:

a. Same material, finish, and thickness as jacket.

b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.

c. Tee covers.

d. Flange and union covers.

e. End caps.

f. Beveled collars.

g. Valve covers.

h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

O. Ends of insulation shall be sealed with material as recommended by the manufacturer.

P. A complete moisture and vapor seal shall be provided wherever insulation terminates against metal hangers, anchors and other projections through insulation on cold surfaces.

Q. Fire Hazard Rating: Insulation materials, coatings and other accessories shall individually have a fire hazard rating not to exceed 25 for flame spread and 50 for fuel contributed and smoke developed. Ratings shall be determined by U.L. "Test Method for Fire Hazard Classification of Building Materials", No. 823 or NFPA No. 225 or ASTM E84.

R. Identification: Furnish and apply piping identification to all piping, showing direction of flow approximately 30'- 0" O.C. on bottom, side or top of all pipes. Furnish and apply name or classification of service adjacent to each arrow. Piping identification shall be plastic cloth pipe markers.

2.12 ACOUSTIC DUCT LINER

A. Furnish and install flexible duct liner insulation in the following locations:

1. Energy Recovery Units – minimum of 15 feet adjacent to the unit for outdoor air and exhaust ducts

2. Transfer Ducts (in plenum spaces) - entire length of duct.

3. Fan Coils – minimum 15 feet immediately adjacent to the unit for all supply and return connections

4. Variable Air Volume Terminal Units – all supply

5. Make-up Air Units – supply ducts

B. Duct liner shall be flexible, fabricated from glass fibers bonded with thermosetting resin. Airstream surface to be protected with an acrylic surface coating that does not support microbial growth as per ASTM C1071 and ASTM C1104.

C. Duct liner to be 1" thick, 1-1/2 lb. per cu.ft. density.

D. "K" ("ksi") Value: ASTM C 518, 0.25 at 75 °F.

E. Noise Reduction Coefficient: NRC = .70 or higher based on Type "A" mounting, tested in accordance to ASTM C 423.

F. Maximum Velocity: 5,000 ft/min.

G. Adhesive: Meeting ASTM C 916.

H. Fasteners: Manufactured duct liner galvanized steel pins, welded or mechanically fastened.

I. Liner installation to be in strict accordance with manufacturer's recommendations.

2.13 REGISTERS, GRILLES AND DIFFUSERS

A. Titus, Price, Tuttle & Bailey or approved equal. All air outlet finishes and color shall be as selected by the Architect and/or Engineer.

B. Supply Air Devices:

1. Ceiling diffusers (SD1): Extruded aluminum construction, with baked acrylic enamel paint finish. Furnish with jet induction diffusing vanes to be located between discharge vanes. Diffusing vanes shall extend to the diffuser face and shall be designed to compress the air into jets which will induce room air. Jets from adjacent channels shall discharge in opposite directions to insure rapid mixing of primary and room air. Furnish with extruded aluminum, opposed blade volume control damper. Sizes and capacities to be as scheduled on the contract drawings. Provide radiations where penetrating floor/ceiling assemblies.

2. Ceiling Diffuser (SD2): Steel construction, with baked acrylic enamel paint finish, intended for use in kitchen areas. Provide with perforated face and blow pattern as indicated. Sizes and capacities to be as scheduled on the contract drawings. Provide radiations where penetrating floor/ceiling assemblies.

3. Supply Registers (SR): Heavy gauge steel construction with 1 ¼ - inch overlap margin, countersunk screw holes and mounting screws. Supply registers shall adjustable vertical face bars, ¾-inch on center with rear diffusing vanes. Provide with integral opposed blade damper designed for screwdriver operation. Provide radiations where penetrating floor/ceiling assemblies.

4. Linear Diffusers (LD): Heavy gauge steel construction with 1 ¼ - inch overlap margin, countersunk screw holes and mounting screws. Linear diffusers shall have adjustable vanes, to direct discharge airflow and blank-off panels as necessary for continuous appearance. Provide with integral opposed blade damper designed for screwdriver operation. Provide insulated plenum box for each diffuser.

C. Return-Air (RR) Registers: Steel return grilles shall be of steel construction with a 1¼-inch wide border on all sides and ¾-inch blade spacing of the sizes and mounting types shown on the plans and outlet schedule. The fixed deflection blades shall be available parallel to the long or short dimension of the grille. Screw holes shall be countersunk for a neat appearance. Corners shall be welded with full penetration resistance welds.

1. Deflection blades shall be contoured to a specifically designed and tested cross-section to meet published test performance data. Blades shall be firmly held in place by mullions from behind the grille and fixed to the grille by welding in place. Blade deflection angle shall be available at 0°.

2. Provide register with optional opposed-blade volume damper constructed of heavy gauge steel. Damper must be operable from the face of the grille.

3. The grille finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315° F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film.

4. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.

5. The manufacturer shall provide published performance data for the grille. The grille shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.

6. At all branch takeoffs and where indicated provide vane deflectors (extractors) behind registers and omit volume damper.

7. Provide diffuser frame type (lay-in, surface mount, snap-in or spline) to match ceiling type.

D. Exhaust (ER): Of similar material and construction as return-air registers except with horizontal face bars fixed at 0 deg. Angle, with bar spacing of ½" on center. Provide with integral opposed blade damper designed for screwdriver operation. Provide radiations where penetrating floor/ceiling assemblies.

E. Linear Returns (LR): Heavy gauge steel construction with 1 ¼ - inch overlap margin, countersunk screw holes and mounting screws. Linear returns shall have adjustable vanes and blank-off panels as necessary for continuous appearance. Provide insulated plenum box for each section of return, coordinate dimensions and quantity with ceiling grid or framing as necessary.

F. At duct mounted registers and where indicated provide vane deflectors (extractors) behind supply registers and omit volume damper.

G. Provide register and diffuser frame type (lay-in, surface mount, snap-in or spline) to match ceiling type.

2.14 EXTERIOR WALL SEAL, OUTLET & PROTECTIVE COVERING

A. The exterior wall seal outlet shall consist of light density wall gasket, rigid plastic wall mount housing, elastomeric compression sleeve, adjustable stainless-steel clamp and wall fasteners. Sleeve and pipe clamp shall create a mechanical connection, securing the piping, pipe insulation and protective cover.

B. The exposed (to weather) refrigerant piping shall be insulated as specified and in compliance with local energy conservation code. All exposed piping shall be provided with a protective covering.

1. The first six (6) feet of piping following the wall seal outlet shall be provided with a flexible PVC plastic UV/weather protective cover, removable/reusable for maintenance and fully enclosing the piping. The covering shall protect from sunlight, moisture, equipment maintenance, wind, snow, ice, rodent damage, physical damage, etc. and shall provide shielding from solar radiation (ultra-violet) that can cause degradation of the insulating material. The covering shall be outdoor industrial grade meeting the following standards: ASTEM E 96, ASTM G 153, ASTM D 412, ASTM 570, ASTM E 84 and ASTM G 21, as well as rating 1 perm or less class II vapor retarder per ASTM E 96.

2. The remaining length of piping shall be protected as above or with field-applied or pre-applied protective finishing and/or vapor sealing, operating within the range of -94°f (-70°c) and 300°f (149°c), jacketed with laminated, flexible, self-adhering, protective jacketing, vapor barrier and weather proofing membrane, having a high performance acrylic adhesive capable of installation with no additional mechanical attachment. Material shall be (5ply) white (white membrane), with finish coordinated through architect. Jacketing material shall have a maximum flame spread/smoke developed index of 10/20 per UL 723 test, a 0.000 water vapor permeance rating per ASTM E-96, and mold inhibitors incorporated. All products shall be UV stable. Products shall be such as Ventureclad 1577cw or approved equal

2.15 LOUVERS

A. Furnish and install stationary louvers of the sizes as shown on the Contract Drawings.

B. The fixed wall louvers shall have heads, sills, jambs and mullions of one (1) piece structural members of 6063-T52 alloy, 0.125 inch (3.18 mm) thick with integral caulking slot and retaining beads. Mullions shall be sliding interlock type with double integral internal drains. Drainable blade to be minimum 0.081 inch (2.06 mm) thick with front lip gutter and recessed second gutter designed to catch and direct water to jamb and mullion drains. Closed cell PVC compression gaskets to be provided between bottom of mullion or jamb and top of sill to insure leak tight connections. Structural supports to be designed to carry a wind load of not less than thirty (30) pounds per square foot. All fasteners to be stainless steel or aluminum. All louvers shall be furnished with aluminum mesh insect screen. Screening shall be replaceable.

C. Manufacturer to submit AMCA500 test data on a 4 foot x 4 foot unit showing that the louver shall pass less than 0.005 ounces per square foot of free area at 1100 FPM free area velocity with a pressure drop of less than 0.24 inches w.g. AMCA data shall also show a 4 foot x 4 foot unit to have a minimum of 8.0 square feet free area.

D. Louvers shall be finished with baked acrylic enamel paint, containing minimum 50% Kynar. Submit color chips to Architect for approval.

E. Louvers shall be Ruskin Model ELF 6375D, Louvers and Dampers Model IEL, Construction Specialties Model 6097, or equal

2.16 HANGERS, SUPPORTS, ANCHORS, GUIDES, SLEEVES AND MISCELLANEOUS STEEL

A. Pipe Hangers, Supports and Inserts:

1. Carpenter and Patterson, Grinnell, Calco, or approved equal. Figure numbers listed are Carpenter and Patterson numbers.

2. General: Piping systems shall be supported in accordance with ANSI B31.1 so as to maintain required pitch of lines, prevent vibration, and provide for expansion and contraction movement.

3. Piping hangers and supports shall be furnished and installed for piping. Provide all components (i.e., inserts, rods, clamps, hangers, washer, lock nuts, rollers, etc.) necessary for a complete installation.

4. Hangers:

a. Hangers for refrigerant liquid (RLL), refrigerant suction (RLS) and condensate drain (CD) piping shall be Figure 100SH refrigeration hanger and shield.

b. Hangers for all other piping shall be Figure 1A Bands.

c. All hangers shall be with supporting rods and nuts. Rod sizes shall be as follows:

1)	Hangers for pipes 4" and larger	5/8"
2)	Hangers for pipes 2-1/2" and 3"	1/2"
3)	Hangers for pipes 2" and smaller	3/8"

5. Pipe covering protection saddles shall be Series 350 galvanized steel and shall be furnished for installation at each hanger where pipes are insulated.

   a. Upper Attachments to Building Structure:

   b. Reinforced Concrete Construction: Upper attachment welded or clamped to steel clip angles which are expansion-bolted to the concrete. Expansion bolting shall be located so that piping loads place bolts in shear.

   c. Structural Framing: Upper attachments welded or clamped to structural steel members. Additional steel members may be necessary in some support locations where piping locations differ from that known on contract drawings.

   d. Submit details for approval.

6. Expansion Fasteners and Power Set Fasteners: In concrete ceiling construction, expansion fasteners may be used for hanger loads up to one-third the manufacturer's rated strength of the expansion fastener. Power set fasteners may be used for loads up to one-fourth of rated load. When greater hanger loads are encountered, additional fasteners may be used and interconnected with steel members combining to support the hanger.

B. Pipe guides and Anchors:

1. Furnish and install where shown on the drawings, a system of main anchors and pipe guides to control the expansion of the new water distribution piping. Temperature fluctuation shall be between 40°F and 240°F.

2. Pipe guides shall be 4-finger spider-and-sleeve type to insure multiple guiding and to allow for complete insulation of piping. Spider and sleeve shall be formed of two halves to facilitate installation of spider on pipe and mounting of guide to structure. Guides shall be provided in accordance with "Standards of the Expansion Joint Manufacturer's Association", latest edition. Guides shall provide up to 6" of axial pipe movement. Assembly to be fabricated of carbon steel and finished with one coat of rust inhibitive paint.

C. Pipe Sleeves:

1. Furnish pipe sleeves for all pipes which pass through masonry floors and walls. Sleeves shall be Schedule 10 steel pipe. Sleeves shall be of the first possible size

larger than the outside of the insulation jacket on covered piping and the first possible size larger than the outside of the piping on uncovered pipes.

2. Sleeves shall be of sufficient length so as to be flush on either side of masonry walls, flush on underside of masonry floor and extend 2" above the finished floor.

D. Escutcheon Plates:

1. Provide one piece or hinged type wall and ceiling expansion-type plates with round head setscrews or integral pipe clips. Provide recessed type for floors. For copper lines and in finished rooms provide minimum 18-gage spun brass, chrome plated over nickel plates. For all other areas, provide 18-gage enameled cast-iron or steel plates.

2.17 VIBRATION ISOLATION

A. General:

1. All vibration isolators shall be the product of a single approved manufacturer.

2. Model numbers hereinafter specified are from Mason Industries. Other equivalent units by Consolidated Kinetics, Vibration Mountings and Controls or approved equal are acceptable.

B. Piping:

1. Steel spring and 0.3″ deflection neoprene element in series. The neoprene element shall be molded with a rod isolation bushing that passes through the hanger box. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection.

C. All vibration isolators for mechanical equipment hung in ceiling shall be selected in accordance with the weight distribution of the equipment to be served so as to produce a uniform deflection. Deflections shall be as hereinbefore specified.

D. Submittals shall include all spring deflections, spring diameters, scale drawings, attachment details, and rated capacity indicating adequacy for each piece of equipment served.

2.18 ADHESIVES, COATINGS, PAINTS AND SEALANTS:

A. All adhesives, sealants, paints and coatings used in the installation of Mechanical equipment must be low-emitting materials, not exceeding the applicable VOC Limits established for LEED Indoor Environmental Quality credits 4.1 and 4.2.

1. Sealants shall not exceed the VOC Limit of 250g/L.

2.19 FIRE-STOPPING

A. Provide asbestos-free fire-stopping material capable of maintaining an effective barrier against flame, gases, and temperature. Provide noncombustible fire-stopping that is

nontoxic to human beings during installation or during fire conditions. Devices and equipment for fire-stopping service shall be UL FRD listed or FM P7825 approved for use with applicable construction, and penetrating items.

1. Fire Hazard Classification: Materials shall have a flame spread of 25 or less, a smoke developed rating of 50 or less when tested in accordance with UL 723 or UL listed and accepted.

2. Fire-stopping Rating: Fire-stopping materials shall be UL FRD listed or FM P7825 approved for "F" and "T" ratings at least equal to fire-rating of fire wall or floor in which penetrated openings are to be protected, except that "F" and "T" ratings may be 3 hours for firestopping in through-penetrations of 4-hour fire rated wall or floor.

2.20 AUTOMATIC TEMPERATURE CONTROLS

A. Provide control components and low voltage wiring for each system as required for the sequence of operation indicated. Provide all required control panels, software and appurtenances for a complete and operable system.

B. Furnish and install all equipment with the necessary options and appurtenances for a fully functioning system operating per the sequences indicated.

C. Contractor shall coordinate all new devices to be compatible with the existing systems and components.

D. Equipment:

1. Controllers

a. General: Provide NAE (Network Automated Engine), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), and Smart Actuators (SA) as required to achieve performance specified in this section.

b. BACnet:

1) NAE (Network Automated Engine): Each NAE shall have demonstrated interoperability during at least one BMA Interoperability Workshop & shall substantially conform to BACnet Building Controller (B-NAE) device profile specified in ASHRAE/ANSI 135-2001 BACnet Annex L.

2) Advanced Application Controllers (AACs): Each AAC shall have demonstrated interoperability during at least one BMA Interoperability Workshop and shall substantially conform to BACnet Advanced Application Controller (B-AAC) device profile as specified in ASHRAE/ANSI 135-2001 BACnet Annex L.

3) Application Specific Controllers (ASCs): Each ASC shall conform to BACnet Application Specific Controller (B-ASC) device profile as specified in ASHRAE/ANSI 135-2001, BACnet Annex Land shall be listed as a certified B-ASC in the BACnet Testing Laboratories (BTL) Product Listing.

4) Smart Actuators (SAs): Each SA shall conform to BACnet Smart Actuator (B-SA) device profile as specified in ASHRAE/ANSI 135-2001, BACnet Annex L and shall be listed as a certified B-SA in the BACnet Testing Laboratories (BTL) Product Listing.

5) BACnet Communication:

a) Each NAE shall reside on or be connected to a BACnet network using ISO 8802-3 (Ethernet) Data Linkl Physical layer protocol and BACnet IIP addressing.
b) BACnet routing shall be performed by NAEs or other BACnet device routers as necessary to connect NAEs to networks of AACs and ASCs.
c) Each AAC and ASC shall reside on a BACnet network using the ARCNET or MSITP Data Linkl Physical layer protocol.
d) Each SA shall reside on a BACnet network using the MS/TP Data Link/Physical layer protocol.

c. Communication:

1) Service Port: Each controller shall provide a service communication port for connection to a Portable Operator's Terminal. Connection shall be extended to space temperature sensor ports where shown on drawings.

2) Signal Management: NAE and ASC operating systems shall manage input and output communication signals to allow distributed controllers to share real and virtual object information and to allow for central monitoring and alarms.

3) Data Sharing: Each NAE and AAC shall share data as required with each networked NAE and AAC.

4) Stand-Alone Operation: Each piece of equipment shall be controlled by a single controller to provide stand-alone control in the event of communication failure. All I/O points specified for a piece of equipment shall be integral to its controller. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network.

d. Environment: Controller hardware shall be suitable for anticipated ambient conditions.

1) Controllers used outdoors or in wet ambient conditions shall be mounted in waterproof enclosures and shall be rated for operation at -29 ° C to 60 ° C (-20 °F to 140 °F).

2) Controllers used in conditioned space shall be mounted in dust-protective enclosures and shall be rated for operation at 0 ° C to 50 ° C (32 ° F to 120 ° F).

3) Keypad: Provide a local keypad and display for each NAE and AAC. Operator shall be able to use keypad to view and edit data. Keypad and display shall require password to prevent unauthorized use. If the manufacturer does not provide a keypad and display for each NAE and AAC, provide a Portable Operator's Terminal for the system.

e. Real-Time Clock: Controllers that perform scheduling shall have a real-time clock.

f. Serviceability:

1) Controllers shall have diagnostic LEDs for power, communication, and processor.

2) Wires shall be connected to a field-removable modular terminal strip or to a termination card connected by a ribbon cable.

3) Each NAE and AAC shall continually check its processor and memory circuit status and shall generate an alarm on abnormal operation. System shall continuously check controller network and generate alarm for each controller that fails to respond.

g. Memory:

1) Controller memory shall support operating system, database, and programming requirements.

2) Each NAE and AAC shall retain BIOS and application programming for at least 72 hours in the event of power loss.

3) Each ASC and SA shall use nonvolatile memory and shall retain BIOS and application programming in the event of power loss. System shall automatically download dynamic control parameters following power loss.

h. Immunity to Power and Noise: Controllers shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).

i. Transformer: ASC power supply shall be fused or current limiting and shall be rated at a minimum of 125% of ASC power consumption.

2. Input and Output Interface

a. General: Hard-wire input and output points to NAEs, AACs, ASCs, or SAs.

b. Protection: Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with up to 24 V for any duration shall cause no controller damage.

c. Binary Inputs: Binary inputs shall monitor the on and off signal from a remote device. Binary inputs shall provide a wetting current of at least 12 mA and shall be protected against contact bounce and noise. Binary inputs shall sense dry contact closure without application of power external to the controller.

d. Pulse Accumulation Inputs: Pulse accumulation inputs shall conform to binary input requirements and shall accumulate up to 10 pulses per second.

e. Analog Inputs: Analog inputs shall monitor low-voltage (0-10 Vdc), current (4-20 mA), or resistance (thermistor or RTD) signals. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.

f. Binary Outputs: Binary outputs shall send a pulsed low-voltage signal for pulse width modulation control or an on-or-off signal for on and off control. All binary outputs on Building Controllers (NAE), Advanced Application Controllers (AAC), and Application Specific Controllers (ASC) shall have three-position (on-off-auto) override switches and status lights. Outputs shall be selectable for normally open or normally closed operation.

g. Analog Outputs: Analog outputs shall send a modulating 0-10 Vdc or 4-20 mA signal as required to properly control output devices. All analog outputs on Building Controllers (NAE), Advanced Application Controllers (AAC), and Application Specific Controllers (ASC) shall have a two-position (auto-manual) switch, a manually adjustable potentiometer, and status lights. Analog outputs shall not drift more than 0.4% of range annually.

h. Tn-State Outputs: Control three-point floating electronic actuators without feedback with tn-state outputs (two coordinated binary outputs) in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers. Provide manual override capability via hardware switch (drive open-neutral-drive closed) at the local Controller level for each tri-state output.

i. Universal Inputs and Outputs. Controller inputs and outputs shall be universal. Input or output shall be designated binary or analog in software and shall be assigned appropriate properties. Non-universal inputs and outputs may be substituted for universal inputs and outputs provided control meets the requirements of Sequences of Operation (see drawings).

j. Power Supplies: Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

1) DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.

2) Unit shall operate between 0 ° C and 50 °C (32 °F and 120 °F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.

3) Line voltage units shall be UL recognized and CSA listed.

k. Power Line Filtering: Provide internal or external transient voltage and surge suppression for workstations and controllers. Surge protection shall have:

1) Dielectric strength of 1000 V minimum

2) Response time of 10 nanoseconds or less

3) Transverse mode noise attenuation of 65 dB or greater

4) Common mode noise attenuation of 150 dB or greater at 40-100 Hz

3. Automatic Control Valves

a. Control valves shall be two-way or three-way pattern as shown, constructed for tight shut off and shall operate satisfactorily against system pressures and differentials. Two-way control valves shall exhibit equal percentage characteristics. Valves with size up to and including 2" shall be screwed with 250 psi ANSI pressure body rating; 2-1/2" and larger valves shall be flanged configuration. Proportional control valves shall be sized for a maximum pressure drop of 4.0 psig at rated flow (except as noted). Two-position control valves shall be line size and shall be provided with a 250 psi static pressure body rating.

b. All valves shall be capable of operating in sequence when required by the sequence of operation. All control valves shall be sized by the control manufacturer and shall be guaranteed to meet heating and cooling loads specified.

c. All control valves shall be suitable for the pressure conditions and shall close against the differential pressure involved. Valve operator connection

type (screwed of flanged) shall conform to pipe schedule in this specification.

d. Hot water control valves shall be normally open, single seated type with equal percentage flow characteristics. The valve discs shall be composition type with bronze trim.

e. Valves shall be sized on the exact pressure drop for the equipment served to prevent over or under sizing the valves. Provide a separate submittal with all of this information included.

4. Damper

a. General:

1) Automatic dampers, furnished by ATC contractor, shall be single or multiple blade as required and/or shown on the drawings.

2) Numerous references are made in this specification as to the responsibility of furnishing and installation of dampers and operators. The ATC contractor shall closely coordinate his work with the HVAC Sub-Contractor to assure that all dampers are provided as required, and he shall examine all pertinent specification sections to assure that all dampers required but not provided by equipment manufacturers are provided under this contract.

3) All blank-off plates and conversions necessary to install smaller than duct sized dampers are the responsibility of the HVAC Sub-Contractor.

4) Dampers shall be installed by the HVAC Sub-Contractor under the supervision of the ATC contractor.

5) Operators shall be provided by the ATC contractor for all types of dampers whether they are provided by equipment manufacturer or by the ATC contractor.

6) Dampers:

a) All damper frames shall be constructed of 13 gauge galvanized sheet metal and shall have flanges for duct mounting. Dampers installed in stainless steel and aluminum duct work shall be constructed of type 316L stainless steel (frame and blades).
b) Damper blades shall not exceed six (6) inches in width. All blades shall be of corrugated type construction, fabricated from two (2) sheets of 22 gauge galvanized sheet steel, spot welded together, blades shall be suitable for high velocity performance. Damper leakage shall be 2% or less at 5" W.C.
c) All damper bearings shall be made of nylon. Bushings that turn in the bearings shall be oil impregnated sintered metal.

d) Leakage and flow characteristic charts must be submitted to the Engineer prior to installation.

5. Actuators And/Or Operators:

a. All damper actuators/operators shall be fully proportioning, unless otherwise specified. They shall be quiet in operation and shall have ample power to overcome friction for damper linkage and air pressure acting on louvers to position dampers accurately and smoothly. The damper actuator/operator mounting arrangement shall be outside the airstream wherever possible, with a maximum of 16 square feet per actuator/operator.

b. The actuators/operators shall be capable of operating at varying rates of speed to correspond to the dictates of the controllers and variable load requirements. The actuators/ operators shall be capable of operating in sequence when required by the sequence of operation. The actuators/operator shall have external adjustable stops to limit the stroke in either direction. The actuator/operator linkage arrangement shall be such as to permit normally open or normally closed positions of dampers as required.

c. All dampers sequenced with valves or dampers shall be furnished with pilot positioners or panel mounted positive positioning relays to ensure proper control sequencing.

d. For exact requirement and quantities of actuators/operators, see plans and coordinate with the HVAC Sub-Contractor.

6. Valve And Damper Actuators (Electronic):

a. Actuators shall be of the gear train or hydraulic type.

b. Actuators shall have integral mechanical stroke limiting adjustments to prevent actuator overstroke and automatic load sensing to protect from motor burnout in stall condition.

c. All actuators shall be sized by the ATC contractor and guaranteed to provide torque and stroke characteristics for the applied duty. Output shall be compatible with outputs of the controlling device. All actuators shall be of the spring return type, linked normally open or closed as applicable and common to the application.

d. All actuators shall be of the direct analog fully proportioning variety. Two position or floating type control actuators may be used only if specifically mentioned in the sequence of operation.

7. Temperature Sensors: Temperature sensors shall be RTDs or thermistors. Sensor Time Constant shall not exceed 5 seconds for a 60% response to a step change in temperature. Sensor repeatability shall be 0.1 °F or better.

a. Space temperature sensor element shall be accurate within +0.5 ° F over a range from 40 ° F to 100 °F. Sensors shall be housed in manufacturer standard miniature type thermostat cover and shall include exposed thermometer, setpoint adjustment and override button as specifically called for in the sequence of operation.

b. Outside air temperature sensor elements for each of the controllers shall be accurate within +0.5 ° F over a range from -20 °F to 120 °F.

c. Duct sensors shall be of the averaging type. Element length shall be adequate for sensing the average cross-sectional temperature over the full duct cross-section.

8. Pressure Switches: The pressure switches shall meet but not be limited to the following specifications:

a. Sensing elements shall be capsule, diaphragm, bellow, bourdon tube, or solid state capable of withstanding 150% of rated pressure (sensor).

b. Switch actuation shall be adjustable for the specified application.

c. Switch shall have snap-action Form C contact rated for the application.

d. Gauge pressure switches shall have adjustable differential settings.

e. Accuracy of +1% of the switch setting.

f. Flow Switches: Flow switches shall meet but not be limited to the following specifications:

1) Repetitive accuracy of +1% of operating range.

2) Switch actuation adjustable over the operating flow range.

9. Low Limit Thermostat: Electric low temperature warning thermostats shall have low point sensitive elements installed to cover the entire duct area, with minimum coverage of (20 linear feet minimum). These thermostats shall be two-position manual reset type. Where coils are two-banks, two (2) sets of freezestats, wired in series, shall be provided and hard-wired to shut down the supply and return fans and show an alarm on the FMCS, as applicable and specified herein.

10. CO2 Sensors

a. Furnish carbon dioxide sensors where shown on the drawings and as required to meet the sequence of control. Units to be either space or duct mounted as required.

b. CO2 Sensor to operate on non-dispersive infrared (NDIR) sensing technology, and provide a 0-10 VDC output signal corresponding linearly to 0-2000 PPM of CO2 Sensor to include a membrane filter to prevent

contaminants from entering the chamber, but shall remain totally permeable to CO2.

c. CO2 Sensor shall include a resident microprocessor based offset compensation algorithm to automatically compensate for drift. Device shall require calibration only or on annual basis. Algorithm shall include a self-test to detect sensor out-of-range situations or other trouble conditions, and initiate an alarm signal. Microprocessor shall allow for span of output range adjustment via one button.

d. Sensor shall operate on any voltage from 20 to 30 VDC or VAC, 50 to 60 HZ.

e. Furnish 24 VAC control transformer (as required) power and control wiring, and single-point calibration kit.

11. Smoke Detection System:

a. Smoke detectors shall be furnished and wired to building alarm system by the Electrical contractor. Smoke detector shall be installed by the Contractor. All hard-wired interlocking for shutdown of fans shall be by the ATC contractor, with an alarm sent to the Network 8000 Host.

b. Except as otherwise specifically indicated, all supply, return and/or exhaust/ ventilation systems 2000 cfm and larger that are interlocked with the air handling unit shall automatically stop when the in-duct smoke detectors are activated.

12. Miscellaneous Control Panels: Details of each panel shall be submitted for review prior to fabrication. Locations of each panel shall be convenient for adjustment and service. Provide engraved nameplate beneath each panel mounted control device clearly describing the function of said device and range of operation. All manual switches shall be flush mounted on the hinged door.

13. All electrical devices within the panels shall be factory pre-wired to a numbered terminal strip. All wiring within the panel shall be in accordance with NEMA and UL Standards and shall meet all Local Codes. All wiring in occupied spaces shall be concealed whenever possible. Any exposed wiring shall be enclosed in painted wiremold, color as selected by the Massachusetts Army National Guard.

14. Sequences of Operation: Provide control components for each system as required for the sequence of operation indicated on the contract drawings.

PART 3 - EXECUTION

3.01 GENERAL

A. Install all items specified under SECTION 23 00 00, according to the applicable manufacturer's recommendations and shop drawings, the details shown on the drawings and as specified under this section. Provide all required hangers and supports.

B. All welding done under this section shall be performed by experienced welders in a neat and workmanlike manner. All welding done on piping, pressure vessels and structural steel under this section shall be performed only by persons who are currently qualified in accordance with ANSI Code B31.1 for Pressure Piping and certified by the American Welding Society, ASME or an approved independent testing laboratory; and each such welder shall present his certificate attesting his qualifications to the Engineer's representative whenever requested to do so on the job.

C. All pipe welding shall be oxyacetylene or electric arc. High test welding rods suitable for the material to be welded shall be used throughout. All special fittings shall be carefully laid out and joints shall be accurately matched intersections. Care shall be exercised to prevent the occurrence of protruded weld metal into the pipe. All welds shall be of sound metal free from laps, cold shots, gas pockets, oxide inclusions and similar defects.

D. All necessary precautions shall be taken to prevent fire or damage occurring as the result of welding operations.

E. Hot Work Safety:

1. The subcontractor is directed to the local Fire Department for instructions related to the cutting/welding and other hot work applications. The contractor must have a valid NFPA hot work safety certification number on the cutting/welding and other hot work application. All persons performing hot work must have a NFPA hot work safety certification on their person when performing hot work.

3.02 DEMOLITION

A. The existing facility will continue to operate during all phases of the demolition work and subsequent construction. The building will be occupied and demolition cannot interrupt regular business or the ability to serve the public.

B. Provide temporary shoring or bracing during the demolition work to prevent movement, settlement, or collapse of the system or adjacent systems due to the work.

C. Promptly repair any damage caused to adjacent facilities or areas that are designated to remain at no additional cost to the Owner.

D. Equipment:

1. Coordinate with all Contractors and Subcontractors to provide disconnection prior to equipment removal.

2. Remove equipment by unfastening at the supports or attachments. All indoor air handlers will need to be cut up into pieces. Then remove the attachments from the building, leaving no component of the original installation.

3. Exercise care with air handling unit motors and other equipment that is to be relocated or turned over to the Owner (equipment to be turned over to owner shall be determined by the owner). Examine the equipment before removal in the presence of the Owner's Representative to determine its condition. Make a record

of any marks, by a photograph or videotape acknowledged by the Owner's Representative. Deliver to a location designated by the Owner, and obtain acknowledgement of receipt in good condition.

4. All equipment, removed but not turned over to the Owner, shall become the property of the General Contractor and shall be removed from the site.

E. Remove existing equipment and appurtenances as indicated on demolition plans and as required to install the new systems.

F. All equipment and materials indicated to be demolished shall be disconnected, capped and otherwise made inactive as required then removed and properly disposed of by the HVAC contractor. The HVAC contractor shall coordinate with the General Contractor as required.

G. The HVAC contractor shall be responsible for disconnect and reinstallation of any HVAC equipment temporarily interrupted during construction.

H. The General Contractor shall remove and dispose of all dirt, debris, rubbish, waste materials, caused by the performance of this work.

3.03 EQUIPMENT

A. Equipment shall be installed complete with all required hangers and supports in accordance with the manufacturer's recommendations.

B. All equipment provided under this Section shall be installed in strict accordance with manufacturer’s written installation instructions.

C. Furnish and install all steel structural support members for proper hanging and support of equipment. Provide vibration isolation on all hangers.

D. The HVAC Sub-Contractor shall label all equipment. Subcontractors will provide HBS with excel spreadsheets of all items to be labeled, HBS will assign numbers, assign names, print out labels and provide subcontractors with labels. Subcontractor will then affix the labels to the equipment. Brass tags are eliminated. As-builts and manuals will reference HBS provided numbers and names.

3.04 PIPING AND FITTINGS

A. Provide and erect in a workmanlike manner according to the best practices of the trade, all piping shown on the plans or required to complete the installation intended by these specifications.

B. This contractor shall inform himself from the Architect's specifications and detailed drawings of the exact dimensions of finished work in all rooms where equipment or pipes are to be placed, and arrange his work accordingly, assuming all responsibility for conformity with the surrounding work.

C. In the erection of mains, special care must be used in their support and proper allowance shall be made for expansion.

D. All steel piping larger than 2" shall have welded joints made by experienced pipe welders. The joints shall all be well filled with metal without interior projections. After welds are made, this contractor shall thoroughly clean inside and leave a smooth bore. Where connections are made on runs, weld-o-lets or thread-o-lets are to be used.

E. All other connections are to be made with screwed fittings.

F. In making welds, this contractor is to have the end of the pipe properly beveled and perfectly lined up.

G. Keep plugged or capped all openings in pipes or fittings.

H. Connections to mains are to be provided with swing arms to provide for expansion.

I. Make such offsets as are shown or required to place pipes on risers in proper position or to avoid other work. Make such offsets neatly and properly locate them to the satisfaction of the Architect.

J. All pipe lines are to be provided with sufficient number of flange fittings or unions to make possible the taking down of the pipes without breakage of fittings. Lines 2" in diameter and less may be connected by R & L couplings, unless otherwise required by the Architect. All of the piping shall be erected so as to provide for the easy flow of water and noiseless circulation. Whenever pipes are cut, three wheel cutters are to be used and the pipes are to be carefully reamed out.

K. Due to the extreme limited headroom, all water mains shall be installed perfectly level or with minimum pitch. Install air vents on all high points and drawoff valves on all low points throughout the entire system.

L. The entire piping system shall be provided with shutoff valves and drawoff valves so that sections of the system may be drained without interrupting the entire system.

M. Extreme care shall be exercised in the location of all piping.

N. No crosses or bull head tees shall be used in any part of the work.

O. Piping connections to all equipment shall be made with companion flanges or unions for ease in removal of equipment.

P. Provide approved pipe identification markers and flow direction arrows on all piping. Markers to be at 30' intervals, except in boiler room where they shall be at 10' intervals.

3.05 VALVES AND ACCESSORIES

A. Valves:

1. Valves shall be installed where shown on plans and elsewhere as necessary for the proper operation or balancing of the systems.

2. At completion, this contractor shall install stamped brass tag on each valve held on with brass drain (except on fan-coil unit valves) with numbers. This contractor is to make up schedule with number of each valve. Schedule to describe use of each valve. One copy of schedule to be framed under glass and hung in boiler room. Two more copies are to be supplied to the Architect.

3. Extreme care must be used in locating fin tube radiation valves and fittings in order that they shall be installed so as to be readily accessible.

4. Install on each coil a key type compression air valve.

5. Strainers

6. Strainers shall be installed at all points shown on the plans. All strainers shall be cleaned prior to balancing, and again at completion of installation.

B. Pipe Hangers:

1. Pipe hangers of the types specified shall be installed for the support of all piping. Maximum center-to-center hanger spacing shall be as follows, except as otherwise indicated on the Drawings.

Pipe Size	Max. Spacing
Up to 1-1/4"	5'-0"
1-1/2" and 2"	8'-0"
2-1/2" and 3"	8'-0"
Over 4"	10'-0"

C. Sleeves:

1. Sleeves shall be installed for each pipe passing through masonry floors or walls.

D. Escutcheon Plates:

1. Escutcheon plates shall be installed on all piping passing through finished floors, walls or ceilings. Escutcheon plates shall be sized for outside diameter of insulation and installed after insulation is completed.

E. Specialties:

1. Specialties of the type specified shall be installed at points specified and elsewhere where shown on the drawings.

2. Air vent valves shall be installed at every high point throughout the system.

3.06 VIBRATION ABSORPTION

A. All equipment and piping shall operate without objectionable or unusual noise or vibration, as judged by the Engineer.

B. Rotating equipment shall be fitted with such vibration-absorbing facilities as will be required to limit the transmission of vibration to the building and to the attached piping and breaching. The facilities shall be generally designed to limit this transmission to a maximum of 2%, but a greater amount will be allowed if it does not prove objectionable. The facilities shall also be designed to limit equipment floor loadings to 500 lb/sq. ft. or less. If, in order to accomplish this, the equipment requires the job installation of isolation mountings, inertia blocks, special hangers or other arrangements, these shall be carefully and specifically selected for each piece of equipment.

C. Motor driven equipment shall have the motor, equipment and drive mounted on a common base. Hollow bed plates shall be grouted with a rich cement mortar.

D. Mit shop drawing data for approval by the Engineer showing the make, type, and size of isolation mountings, flexible pipe connectors, and other facilities to be provided, including any concrete inertia blocks that may be required. The data shall clearly indicate that the isolating arrangements can and will limit the transmission of vibration as specified.

3.07 VIBRATION AND ISOLATION

A. Application:

1. Refer to the PRODUCTS section of this specification for vibration isolation devices identified on the drawings or specified herein.

2. The static deflection of all isolators specified herein is the minimum acceptable deflections for the mounts under actual load. Isolators selected solely on the basis of rated deflection are not acceptable and will be disapproved.

B. Major Equipment Isolation:

1. Unless otherwise shown or specified, all floor-mounted major equipment shall be set on housekeeping pads. See architectural or structural drawings for details.

2. Types and minimum static deflections of vibration isolation devices for major equipment items shall be as scheduled on the drawings or specified hereunder.

3. Flexible duct connections shall be installed at all fan unit intakes, fan unit discharges, and wherever else shown on the drawings.

4. Flexible pipe connections shall be installed at all pipe connections to vibration-isolated equipment in the positions shown on the drawings.

5. Electrical connections to vibration-isolated equipment shall be flexible, as called for in the electrical portion of the specification.

6. Thrust restraints shall be installed on all suspended fans and on all floor-mounted fans developing 4" or more of static pressure, unless the horizontal component of the thrust force can be demonstrated to be less than 10% of the equipment weight.

C. Miscellaneous Mechanical Equipment Isolation:

1. Miscellaneous pieces of mechanical equipment, such as converters, pressure reducing stations, dryers, strainers, storage tanks, condensate receiver tanks, and expansion tanks, which are connected to isolated piping systems, shall be vibration-isolated from the building structure by Type NP or Type HN isolators (selected for 0.1" static deflection), unless their position in the piping system requires a higher degree of isolation as called for under Pipe Isolation.

D. Pipe Isolation: All chilled water, condenser water, hot water, steam, refrigerant, drain and engine exhaust piping that is connected to vibration-isolated equipment shall be isolated from the building structure within the following limits:

1. Within mechanical rooms: Within 50' total pipe length of connected vibration-isolated equipment (chillers, pumps, air handling units, pressure reducing stations, etc.); At every support point for piping that is greater than 4" in diameter. Piping shall be isolated from the building structure by means of vibration isolators, resilient lateral supports, and resilient penetration sleeve/seals.

2. Isolators for the first three support points adjacent to connected equipment shall achieve one half the specified static deflection of the isolators supporting the connected equipment. When the required static deflection of these isolators is greater than 1/2", Type FSN or HSN isolators shall be used. When the required static deflection is less than or equal to 1/2", Type FN or HN isolators shall be used. All other pipe support isolators within the specified limits shall be either Type FN or HN achieving at least 1/4" static deflection.

3. Where lateral support of pipes is required within the specified limits, this shall be accomplished by use of resilient lateral supports. Pipes within the specified limits that penetrate the building construction shall be isolated from the building structure by use of resilient penetration sleeve/seals.

4. Provide flexible pipe connections as called for under Major Equipment above and wherever shown on the drawings.

E. Duct Isolation:

1. All sheet metal ducts and air plenums that are within mechanical rooms or within a distance of 50' total duct length of connected vibration-isolated equipment (whichever is longer) shall be isolated from the building structure by Type FN, PCF or HN isolators. All isolators shall achieve 0.1" minimum static deflection.

2. Ducts within the specified limits that penetrate the building construction shall be isolated from the building structure by use of resilient penetration sleeve/seals.

3. Flexible duct connections shall be provided as called for above under Major Equipment and wherever shown on the drawings.

3.08 INSTALLATION OF VIBRATION ISOLATION

A. General

1. Locations of all vibration isolation devices shall be selected for ease of inspection and adjustment as well as for proper operation.

2. Installation of vibration isolation equipment shall be in accordance with the manufacturer's instructions.

B. Isolators

1. All vibration isolators shall be aligned squarely above or below mounting points of the supported equipment.

2. Isolators for equipment with bases shall be located on the sides of the bases which are parallel to the equipment shaft unless this is not possible because of physical constraints.

3. Locate isolators to provide stable support for equipment, without excess rocking. Consideration shall be given to the location of the center of gravity of the system and the location and spacing of the isolators. If necessary, a base with suitable footprint shall be provided to maintain stability of supported equipment, whether or not such a base is specifically called for herein.

4. If a housekeeping pad is provided, the isolators shall bear on the housekeeping pad and the isolator base plates shall rest entirely on the pad.

5. Hanger rods for vibration-isolated support shall be connected to major structural members, not the floor slab between major structural members. Provide suitable intermediate support members as necessary.

6. Vibration isolation hanger elements shall be positioned as high as possible in the hanger rod assembly, but not in contact with the building structure, and so that the hanger housing may rotate a full 360° about the rod axis without contacting any object.

7. Parallel running pipes may be hung together on a trapeze that is isolated from the building. Isolator deflections must be the greatest required by the provisions for pipe isolation for any single pipe on the trapeze. Do not mix isolated and u-isolated pipes on the same trapeze.

8. Pipes, ducts and equipment shall not be supported from other pipes, ducts and equipment.

9. Resiliently isolated pipes, ducts and equipment shall not come in rigid contact with the building construction or rigidly supported equipment.

10. The installed and operating heights of equipment supported by Type FSNTL isolators or with Type RC-2 isolation bases shall be identical. Limit stops shall be out of contact during normal operation. Adjust isolators to provide 1/4" clearance

between the limit stop brackets and the isolator top plate, and between the travel limit nuts and travel limit brackets.

11. Adjust all leveling bolts and hanger rod bolts so that the isolated equipment is level and in proper alignment with connecting ducts or pipes.

C. Bases

1. No equipment unit shall bear directly on vibration isolators unless its own frame is suitably rigid to span between isolators and such direct support is approved by the equipment manufacturer. This provision shall apply whether or not a base frame is called for on the schedule. In the case that a base frame is required for the unit because of the equipment manufacturer's requirements and is not specifically called for on the equipment schedule, a base frame recommended by the equipment manufacturer shall be provided at no additional expense.

2. Unless otherwise indicated, there is to be a minimum operating clearance of 1" between steel rails, steel frame bases or inertia bases and the floor beneath the equipment. The isolator mounting brackets shall be positioned and the isolators adjusted so that the required clearance is maintained. The clearance space shall be checked by the Contractor to ensure that no construction debris has been left to short circuit or restrict the proper operation of the vibration isolation system.

3. Isolation bases shall be installed in strict accordance with the manufacturer’s instructions.

D. Flexible Duct Connections

1. Prior to installation of the flexible connection, sheet metal ducts and plenum openings shall be squarely aligned with the fan discharge, fan intake, or adjacent duct section and the gap between connected parts shall be uniform. Flexible duct connections shall not be installed until this provision is met. There shall be no metal-to-metal contact between connected sections, and the fabric shall not be stretched taut.

E. Flexible Pipe Connections

1. Install flexible pipe connections in strict accordance with the manufacturer's instructions.

F. Thrust Restraints

1. Thrust restraints shall be attached on each side of the fan parallel to the thrust force. This may require custom brackets or standoffs. The body of the thrust restraint shall not come in contact with the connected elements. Thrust restraints shall be adjusted to constrain equipment movement to the specified limit.

G. Grommets

1. Where grommets are required at hold down bolts of isolators, bolt holes shall be properly sized to allow for grommets. The hold down bolt assembly shall include washers to distribute load evenly over the grommets. Bolts and washers shall be galvanized.

H. Resilient Penetration Sleeve/Seals

1. Maintain an airtight seal around the penetrating element and prevent rigid contact between the penetrating element and the building structure. Fit the sleeve tightly to the building construction and seal airtight on both sides of the construction penetrated with acoustical sealant.

3.09 SHEET METAL WORK

A. All of the sheet metal work shall be done by contractors regularly engaged in this type of work.

B. Neatly erect all sheet metal work as shown on plans or as may be required to carry out the intent of these plans and specifications.

C. All necessary allowances and provisions must be made by this subcontractor in the case of beams, posts, pipes, iron work or other obstructions in the construction of the building or the work of other trades whether or not the same is shown on plans.

D. All ducts are to be rigid and are to be strongly and carefully supported with suitable braces or angles to keep them true to shape and to prevent buckling.

E. All joints are to be made tight and all interior surfaces are to be made smooth.

F. Protect all work under this section from injury during the progress of erection and until final acceptance by the Architect.

G. All metal work in dead or furred down spaces is to be erected in time to occasion no delay in the work of other trades on the building.

H. Supply collars to diffusers shall be installed inside the neck of the diffusers. Dampers on all registers and diffusers shall be installed in the open position.

I. Joints in all ductwork throughout shall be sealed, Class-B. All ductwork shall be taped and sealed.

J. During the progress of the work and after the completion of the same, this Subcontractor shall remove from the premises all dirt, debris, rubbish, waste materials, etc., cause by him in the performance of this work, together with all his tools and appliances.

3.10 REFRIGERANT PIPING

A. Remove all foreign material from interior and exterior of pipe and fittings.

B. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where

interferences develop in the field, offset or reroute piping as required to clear such interferences. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

C. Do not route piping through transformer vaults or above transformers, panel boards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment

D. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in this section.

E. Refrigeration piping to be installed by firms who are experienced in installation of such piping.

F. All joints to be brazed and have a melting point greater than 1,125 degrees F. Filler impurities shall not exceed 0.15%. Tubing to be new and delivered to the job site with the original mill end caps in place. Purge all lines with nitrogen during brazing. Provide manual shut-off and check valves as required.

G. No refrigerant is to be vented directly to the atmosphere except that which may escape through leaks in the system during leak testing. During evacuation procedures, use equipment designed to recover and allow recycling of the refrigerant.

H. Leak test the system by charging the system to a pressure of 10 psig with an HFC refrigerant, with the compressor suction and discharge valves closed and with all other system valves open. Increase pressure to 300 psig with dry nitrogen. Rap all joints with a mallet and check for leaks with an electric leak detector having a certified sensitivity of at least one ounce per year. Seal any leaks that may be found and retest.

I. After completion of the leak test, evacuate the system with a vacuum pump to an absolute pressure not exceeding 1500 microns while the system ambient temperature is above 60°F. Break the vacuum to 2 psig with the refrigerant to be used in the system. Repeat the evacuation process, again breaking the vacuum with refrigerant. Install a drier of the required size in the liquid line, open the compressor suction and discharge valves, and evacuate to an absolute pressure not exceeding 500 microns. Leave the vacuum pump running for not less than two hours without interruption. Raise the system pressure to 2 psig with refrigerant and remove the vacuum pump.

J. Charge refrigerant directly from original drums through a combination filter-drier. Each drier may be used for a maximum of three cylinders of refrigerant and then must be replaced with a fresh drier. Charge the system by means of a charging fitting in the liquid line. Weigh the refrigerant drum before charging so that an accurate record can be kept of the weight of refrigerant put in the system. If refrigerant is added to the system through the suction side of the compressor, charge in vapor form only.

3.11 VRF HEAT PUMPS AND FAN COIL UNITS INSTALLATION

A. General:

1. Rig and install in full accordance with manufacturer's requirements, project drawings, and contract documents. Refer to the manufacturer's installation manual for full requirements.

B. Location:

1. Locate indoor and outdoor units as indicated on drawings. Provide service clearance per manufacturer's installation manual. Adjust and level outdoor units on support structure.

2. For climates that experience snowfall, mount the outdoor unit a minimum of 12" above the average snowfall line. In climates where this height requirement proves unfeasible, the outdoor units may be installed at the average snowfall line provided regular snow removal in the area surrounding the units keeps the snow line below the bottom of the units.

C. Components / Piping:

1. Installing contractor shall provide and install all accessories and piping for a fully operational system. Refer to manufacturer's installation manual for full instructions.

2. Traps, filter driers, and sight glasses are NOT to be installed on the refrigerant piping or condensate lines.

3. Standard ACR fittings rated for use with R410A are to be used for all connections. Proprietary manufacturer-specific appurtenances are not allowed.

4. Refrigerant pipe for VRF systems shall be made of phosphorus deoxidized copper.

5. The maximum operation pressure of R410A air conditioner is 623psi. The refrigerant piping shall be tested to ensure safety under the maximum operation pressure. Pipes of radical thickness 0.7mm or less shall not be used.

6. Flare connection should follow dimensions provided in manufacturer's installation manuals.

D. Insulation:

1. Refrigerant lines, as well as any valves, shall be insulated end to end with closed-cell pipe insulation (thickness per schedule) in accordance with state or local code requirements.

E. Electrical:

1. Installing contractor shall coordinate electrical requirements and connections for all power feeds with electrical contractor. Refer to Division 26 for additional information.

F. Third Party Controls:

1. Installing contractor shall coordinate all BAS/BMS control requirements and connections with existing controls systems and components.

3.12 INSULATION

A. All of the insulation work shall be done by contractors regularly engaged in this type of work in a neat and workmanlike manner. All insulation shall be completely sealed with no glass fibers exposed to the air.

B. The entire water piping system, including piping, valve bodies, fittings, specialties, air separator, pump casings, shot feeder, etc., shall be carefully insulated throughout for thermal control and to prevent condensation. Special care shall be exercised to ensure that all piping, valve bodies and fittings are well insulated with vapor barrier at the fan-coil units, up to the final connection at the coil so as to prevent condensation from forming and dripping on the ceiling. All insulated equipment which requires servicing shall be insulated with removable sections.

C. All piping insulation in mechanical room shall be enclosed in a PVC Jacket, color to be as selected by the Engineer.

D. The entire air distribution system shall be carefully insulated throughout for thermal control and to prevent condensation. All insulated equipment which requires servicing shall be insulated with removable sections.

3.13 MISCELLANEOUS IRON AND STEEL

A. Provide steel supports and hangers required to support fans, tanks, air handling units, pipe, ductwork, and other equipment or materials. Submit details of steel supports and method of fabrication for approval.

B. All work shall be cut, assembled, welded and finished by skilled mechanics. Welds shall be ground smooth. Stands, brackets, and framework shall be properly sized and strongly constructed.

C. Measurements shall be taken on the job and worked out to suit adjoining and connecting work. All work shall be by experienced metal working mechanics. Members shall be straight and true and accurately fitted. Scale, rust, and burrs shall be removed. Welded joints shall be ground smooth where exposed. Drilling, cutting and fitting shall be done as required to properly install the work and accommodate the work of other trades as directed by them.

D. Members shall be generally welded, except that bolting may be used for field assembly where welding would be impractical. Welders shall be skilled.

E. All shop-fabricated iron and steel work shall be cleaned and dried and given a shop coat of paint on all surfaces and in all openings and crevices.

3.14 FIRE-STOPPING INSTALLATION

A. Install fire-stopping assembly at locations shown and as specified in accordance with UL FRD systems or FM P7825 designs, and as recommended by manufacturer. Do not cover or enclose firestopping assemblies or areas until approved by the Owner's Representative.

1. Completely fill openings around penetrating items with fire-stopping material to prevent spread of fire in the following locations:

a. Around duct, cable, conduit, piping, and their supports that penetrate fire-rated above grade floor slabs, interior partitions, and exterior walls.

b. Around openings and penetrations through fire-rated ceiling assemblies.

c. Around penetration of vertical fire-rated service shafts.

d. Around openings and penetrations through fire-rated enclosures.

e. Other locations indicated.

B. Filling of Voids: Completely fill voids flush with the surface; the depth of material shall be in accordance with UL FRD or FM P7825. Firestopping for filling voids in floors in which smallest dimension of a void is 4" or more shall support the floor design load or be protected by a permanent barrier. Damaged, disrupted, or removed fire-stopping materials or assemblies shall be replaced with new fire-stopping as specified in this section.

C. Insulated Pipes and Ducts: Cut and remove thermal insulation where pipes or ducts pass through fire-stopping. Replace thermal insulation with a material having equal thermal insulating characteristics and equal fire-stopping characteristics.

3.15 AUTOMATIC TEMPERATURE CONTROLS

A. System shall be complete with all control wiring, switches, relays, transformers, and other accessories.

B. The Control System herein specified shall be free from defects in workmanship and material under normal use and service. After completion of the installation, regulate and adjust all thermostats, control valves, control motors, and other equipment provided and/or wired under this contract. If within twelve (12) months from the date of completion, any of the system herein described is proved to be defective in workmanship or materials, it will be replaced or repaired free of charge.

C. Provide any service incidental to the proper performance of the Control System under guarantees outlined above for the period of one year. Normal maintenance of the system or adjustments of components is not to be considered part of the guarantee.

3.16 TESTING

A. All refrigerant piping systems, upon completion of assembly, shall have been pressurized to a minimum 600 PSI, using dry nitrogen, and held for an uninterrupted 24HR period, with acceptable change due to atmospheric conditions.

1. A record of the pressure check process shall be recorded and tagged at the outdoor unit. The tag shall contain the following information: date & time of pressure check start, fill pressure, outdoor temperature at start & stop, date & time of pressure check completion, and the person's full name & company information completing the pressure check.

2. The installing contractor shall engage the General Contractor as a witness of the pressure check process, confirming that all steps and procedures related to the pressure check where properly followed and that the system held the holding pressure of 600PSI for a period of 24hr hours, with acceptable change due to atmospheric conditions. Witness information, including full name, company name, title, phone number and signature shall be recorded on same pressure tag used by installing contractor.

B. Upon completion of the 600 PSI pressure check, the system shall be evacuated to a level of 500 microns, where it will be held for a period of 1HR with no deflection. The installing contractor shall utilize the triple evacuation method per the equipment install and service manuals.

1. Evacuation start & stop dates, times, and persons involved shall be recorded and tagged at the outdoor equipment.

2. Installing contractor shall digitally capture a photo of the micron gauge reading, at the conclusion of the 1hr holding period, for each system and provide a copy to the VRF manufacturer. Each photo shall contain a tag providing the outdoor units Serial number.

C. Upon the completion of the 500-micron hold, the calculated additional refrigerant charge can be added. The calculated refrigerant charge shall have been calculated using the VRF manufacturers design software.

1. Total refrigerant charge of the system shall be recorded and displayed at the outdoor unit by permanent means.

D. Furnish all necessary equipment to conduct the testing of the piping system.

E. A log of all tests shall be kept by the Contractor. The log shall provide a description of the test or inspection, the date performed, and the signatures of the responsible contractor's person performing the work and the witnessing engineer. This log shall form part of the final documentation. Failure to maintain this log will result in re-inspection or testing at the Contractor's expense/

3.17 BALANCING, ADJUSTING, OPERATING, AND INSTRUCTIONS

A. The HVAC Sub-Contractor shall engage the services of an independent firm to perform testing, adjusting and balancing of the HVAC systems. The HVAC subcontractor shall submit to the owner at least qualified firms for the owner's review and acceptance.

B. Engage a balancing company to adjust, balance, and operate the heating, ventilating and air-conditioning system and thoroughly instruct the Owner's personnel in all phases of care and operation of the systems. The Balancing Company shall be certified by Associated Air Balance Council or by the National Environmental Balancing Bureau.

C. Before the air systems are tested and balanced, ducts and equipment shall be thoroughly cleaned by the contractor so that no dirt, dust, or other foreign matter will be deposited in or carried through the systems. For this purpose, cheesecloth shall be placed over each opening for entraining such particles during the cleaning operation.

D. The Balancing Company will not perform water systems balancing until after the systems have been cleaned and treated by the Contractor.

E. Rooftop, air handlers & fan coil units shall not be operated without filters in place. All filters shall be replaced by the Contractor after rooftop units have been cleaned and ready for system balancing.

F. The Contractor as a part of this contract shall provide all materials, labor, and service of all subcontractors for fulfillment of air and water balancing of all systems. The Balancing Company shall inform Contractor of all requirements ahead of time.

G. All equipment shall be operated and adjusted and all air and water systems shall be adjusted and balanced, readings taken and recorded on an approved form submitted to the Engineer for approval, readjusted and rebalanced in accordance with the Engineer's review comments and resubmitted.

H. Air Systems:

1. Systems shall be adjusted and balanced so that air quantities at outlets are as indicated on the drawings and so that the distribution from supply outlets is free from drafts, and uniform over the face of each outlet.

2. Adjustments shall be made by the Balancing Company to volume dampers at air outlets to produce the least pressure drop consistent with volume requirements.

3. After completion of balancing and adjusting, settings of dampers, shall be permanently marked by the Balancing Company so that they can be restored if disturbed at any time.

4. Direct reading velocity meters may be used by the Balancing Company for comparative adjustment of individual outlets, but air quantities in ducts have velocity of 1,000 feet per minute or greater, shall be measured by means of pitot tubes and inclined gauge manometers. Instrument test opening enclosures as specified shall be provided as required.

5. Adjustment of the temperature controls shall be coordinated by the person in charge of the balancing and adjusting and shall be performed coincidental therewith. In conjunction with the Automatic Temperature Control System, simulate a complete cycle of operation for each system.

6. After completion of the testing, balancing and adjusting of the air systems, six copies of a report showing the following information shall be submitted to the Engineer for review and approval. The report shall be arranged as follows:

   a. Location of each air outlet or inlet.

   b. Dimensions or size of each outlet or inlet.

   c. Type: diffuser, grille, register, supply, return exhaust, and Ak value for each.

   d. Cfm of air as indicated on drawings for each outlet or inlet.

   e. Cfm of air as measured, after each complete system has been balanced and adjusted, for each outlet or inlet.

   f. After each complete system has been balanced and adjusted, the total cfm at fan discharge, static pressure at fan outlet, total static pressure for apparatus, fan speed, motor amperage for each phase and voltage shall be listed.

I. The Balancing Company shall provide all instruments and accessories required to perform the tests.

J. Prior to the demolition of the existing hydronic heating system, testing shall be performed to determine water flows and pressure drops in all branches and risers indicated to remain as well as in any branches/risers that are found to serve equipment on the upper floors of the building. This information is to be transmitted to the Engineer for review and to be utilized in balancing of the newly installed system.

K. Upon completion of the systems, during the first stages of the first cooling season, the Balancing Company shall operate the systems until temperatures in all areas are uniform. The period of time shall be no less than a five-day, forty-hour period. During these times, the Balancing Company shall keep at least two men on the job continuously, together with a man from the temperature control Sub-Subcontractor for the purpose of testing and balancing systems.

L. The Contractor shall obtain from the manufacturer of each piece of equipment, five (5) copies of lubrication, operating and maintenance data sheets and control system drawings. He shall prepare five (5) complete sets of written coordinating operating and maintenance instructions into complete operating and maintenance manuals.

3.18 DUCT PRESSURE TEST

A. Ductwork leakage test shall be performed for all ductwork (the entire supply, return and exhaust air systems, etc.). Test procedures, apparatus, and reports shall confirm to the

SMACNA Leakage Test Manual using the maximum static pressure design for each duct system. The maximum allowable leakage rate is defined by the specified SMACNA Static Pressure and Seal Classes. Ductwork leak tests shall be completed with satisfactory results prior to applying insulation to ductwork exterior. Submit test reports to engineer and Owner's Representative for review and approval.

3.19 HVAC SYSTEM AND EQUIPMENT COMMISSIONING

A. Commissioning services to be provided through a licensed professional, regularly engaged in work similar to that of this project.

B. HVAC Contractor and all other sub-Contractors required for the work of this Section shall provide all labor, materials and equipment required to assist with the building commissioning of this project in accordance with the requirements outlined in Division 01.

3.20 PLACING IN SERVICE

A. At the completion of performance tests and following approval of test result, recheck all equipment to see that each item is adequately lubricated and functioning correctly.

3.21 COMPLETION

A. Provide properly executed certificate of inspection from authorities having jurisdiction.

B. Instruct such persons as the Owner designates in the proper operation and maintenance of the systems and their parts. Submit to the Architect a letter naming the person or persons so instructed and the dates of such instruction.

C. Prepare and deliver literature showing operation, service and replacement data for all equipment which will require periodic maintenance or replacement.

D. Verify that project record documents are complete as specified under Submittals and Record Documents.

END OF SECTION

DIVISION 26

SECTION 26 00 00

ELECTRICAL

PART 1 - GENERAL

1.01 GENERAL

A. The Town of Stow Contract along with the "Standard Form of Agreement between Owner and Contractor", AIA Document A101, 2017 Edition – Electronic Format, as published by The American Institute of Architects, together with all Amendments and Supplements as hereinbefore listed, shall apply and are hereby made a part of this section of the Specifications.

B. The sections of these specifications entitled "Special Conditions", "Minimum Wage Determination", and Division 01, "General Requirements" shall apply and are hereby made a part of this section of the Specifications.

C. Examine all Drawings and all Sections of the Specifications for requirements therein affecting the work and this Section. The exact scope of work cannot be determined without a thorough review of all specification sections and other contract documents.

1.02 GENERAL CONDITIONS

A. The "General Conditions, Supplementary General Conditions", and DIVISION 01 govern work under this Division, form a part of this specification and contract and shall be carefully examined by each bidder before submitting his proposal.

1.03 DEFINITIONS

A. Owner – Town of Stow

B. Awarding Authority – Town of Stow

C. Engineer – BLW Engineers, Inc.

D. The Contractor shall be considered the General Contractor and General Bidder.

E. The HVAC Contractor shall be considered to be the HVAC Contractor.

F. The Electrical Contractor shall be considered the Electrical Contractor.

G. "Provide" shall mean furnish and install.

H. "Disconnect" shall mean to electrically disconnect and otherwise make the equipment safe for removal and disposal by others. The Electrical Contractor shall remove conduit and wiring serving disconnected equipment, unless otherwise noted.

I. "Remove" shall mean to "disconnect", remove and dispose of the equipment indicated.

J. "Relocate" shall mean to "disconnect" for relocation of the existing equipment.

K. "Remain" shall mean the existing equipment is to remain in place, in operating condition.

1.04 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals necessary to provide complete electrical system as shown on the Drawings and as specified herein. The major items of work shall generally consist of:

1. Electrical Demolition: Demolition/removal of existing receptacles, lighting and Mechanical equipment and associated existing branch circuitry. The existing electrical service shall be upgraded and existing service conductors and panel board shall be replaced with new.

2. New Electrical Work shall include roof top equipment conduits, new branch circuitry, new disconnects. The work shall generally consist of providing:

a. Raceways, Fittings and Supports
b. Wire and Cable
c. Disconnect Switches
d. Fire Alarm System
e. Lighting and controls
f. Panel boards and Circuit breakers
g. Feeder Circuit Wiring and Connections for new equipment and mechanical units.
h. Grounding
i. Electrical Identification (name plates and labeling)
j. All Fees and Permits
k. Testing
l. Furnish all labor and materials to perform demolition work as indicated on the drawings and specified herein after.

B. During final inspection, the electrical contractor shall be available to the mechanical and electrical engineers to open all electrical/control panels for inspectional purposes.

1.05 RELATED WORK PROVIDED BY THE HVAC CONTRACTOR

A. Control Wiring

1.06 CODES, ORDINANCES, AND PERMITS

A. Installation of systems and equipment provided under this section shall be done in strict accordance with Massachusetts Department of Public Safety Codes, Massachusetts Department of Environmental Protection, Massachusetts State Building Code, the Massachusetts Electrical Code, the National Electrical Code (most recent editions) and the Town of Stow Codes and Regulations having jurisdiction.

B. All electrical apparatus furnished under this section shall be approved by the UL and shall be so labeled or listed where such is applicable. Where custom-built equipment is specified and the UL label or listing is not applicable to the completed product, all components used in the construction of such equipment shall be labeled or listed by UL where such is applicable to the component.

C. Give notices, file plans, pay for and obtain permits and licenses, pay fees and obtain necessary approvals from authorities having jurisdiction. Deliver certificates of inspection and approval to the Engineer. Authorities having jurisdiction include, but are not necessarily limited to:

1. Town of Stow Wiring Inspector (Inspectional Services Department)

D. No work shall be covered before examination and approval by Engineer, inspectors, and authorities having jurisdiction. Replace imperfect or condemned work conforming to requirements, satisfactory to Engineer, and without extra cost to the Owner. If work is covered before due inspection and approval, the installing contractors shall pay costs of uncovering and reinstalling the covering, whether it meets contract requirements or not.

E. In the event local inspectors or codes require a change in the material, design, or involve additional labor, all such changes shall be submitted to the Engineer for approval before proceeding with the work. Comply with all local codes and inspections.

1.07 RECORD DRAWINGS

A. Refer to Section 01 70 00, Project Closeout, of the Specifications for record drawings and procedures to be provided under this section.

1.08 CLEANING

A. During the progress of the electrical work, the Electrical Contractor shall clean up and remove all scrap, demolition material, and other debris caused by the Contractor. At completion, the Electrical Contractor shall clean all electrical equipment, wiring and raceway systems and leave all work in perfect operating condition.

1.09 COORDINATION AND RESPONSIBILITY

A. The structure and its appurtenances, clearances and the related services, such as plumbing, heating, ventilation and electric service have been planned to be legal, adequate and suitable for the installation of equipment specified under this section. The Owner will not assume any increase in cost caused by differing requirements peculiar to a particular make or type of equipment, and any incidental cost shall be borne by the Electrical Contractor. He shall be responsible for the proper location of his required sleeves, chases, inserts, etc., He shall be responsible for his work and equipment furnished and installed by him until the completion and final acceptance of this contract, and he shall replace any work which may be damaged, lost or stolen, without additional cost to the Owner.

1.10 PROTECTION OF MATERIALS, WORK, AND GROUNDS

A. Materials, fixtures and equipment shall be properly protected and all raceway openings shall be temporarily closed so as to prevent obstruction and damage.

B. Protect and preserve all materials, supplies and equipment of every description and all work performed. Protect all existing equipment and property of any kind from damage during the operations. Damage shall be repaired or replaced promptly by the Electrical Contractor at his expense.

1.11 DRAWINGS

A. It is the intention of the Specifications and Drawings to call for finished work, tested and ready for operation. Any apparatus, appliance, material or work not shown on the Drawings, but mentioned in the Specifications or vice-versa, or any incidental accessories necessary to make the work complete in all respects and ready for operation, even if not particularly specified, shall be provided by the Electrical Contractor without additional expense to the Owner.

B. The Drawings are generally diagrammatic. The locations of all items that are not definitely fixed by dimensions are approximate only. The exact locations must be determined at the project and shall have the approval of the Engineer before being installed. The Electrical Contractor shall follow Drawings, including his shop drawings, in laying out work and shall check the Drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions. Where space conditions appear inadequate, notify the Engineer before proceeding with the installation. The Electrical Contractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.

C. Size of raceways and methods of running them are shown, but it is not intended to show every offset and fitting, nor every structural difficulty that may be encountered. To carry out the true intent and purpose of the Drawings, all necessary parts to make complete approved working systems ready for use, shall be furnished without extra charge. All work shall be installed in such a manner as to avoid being unsightly.

D. All measurements shall be taken at the building by the Electrical Contractor, prior to purchasing and installing the equipment and raceways.

1.12 APPROVAL OF MANUFACTURERS AND SHOP DRAWINGS

A. Submit five (5) copies of the following in accordance with Section 01 33 00.

1. Panel boards

2. Disconnects and Safety Switches

3. Wire and Cable

4. Branch Circuit Wiring

5. Conduit and Raceways

6. Wiring Devices and Plates

7. Lighting fixtures and controls

8. Grounding

9. Nameplates Labels, Tags and other Identification Material

10. Fire alarm system including riser diagram and battery calculations. Fire alarm shop drawings must be submitted to the Fire Department for approval.

B. Individual information shall be submitted for each type of equipment. Where multiple products of various sizes, capacities or ratings are indicated on the same page of a submittal, the Electrical Contractor shall clearly identify which items are being submitted. Unmarked submittals will be returned without action. Additional requirements for shop drawings may be contained under individual items.

1.13 UNDERWRITERS' LABEL AND LISTING

A. All electrical apparatus furnished under this Section shall be approved by the UL and shall be labeled or listed where such is applicable. Where custom-built equipment is specified and the UL label or listing is not applicable to the completed product, all components used in the construction of such equipment shall be labeled or listed by UL where such is applicable to the component.

1.14 CUTTING AND PATCHING

A. All cutting and patching necessary for the proper installation of work to be performed under this Section shall be performed by the General Contractor.

B. All work shall be fully coordinated with all phases of construction, in order to minimize the requirements for cutting and patching.

C. All of this work shall be done by careful workmen competent to do such work and with the proper and smallest tools applicable.

D. Any cost caused by defective or ill-timed work shall be borne by the contractor responsible.

1.15 GUARANTEE

A. The Electrical Contractor shall guarantee, in writing, all work and all materials provided under this Section in accordance with the provisions of the printed form of Contract and the General Conditions.

1.16 ELECTRICAL

A. All furnished electrical apparatus and controls shall conform to applicable requirements under DIVISION 26 00 00 - ELECTRICAL.

B. The HVAC Contractor shall furnish and install all low voltage and/or line voltage control wiring for the hvac units unless indicated otherwise.

1.17 VERIFYING EXISTING CONDITIONS

A. Before commencing any work under this section, verify all governing dimensions and examine all adjoining work on which this work is in any way associated or connected. Failure to visit the jobsite will in no way relieve the Electrical Contractor from installing the work according to the intent of these specifications and at no additional cost to the Owner.

B. Each bidder shall visit the site and inspect conditions affecting the proposed work. Failure to do so and misinterpretation of the Plans and Specifications shall be entirely the responsibility of the bidder, and will not be a basis for claim for extra compensation.

C. Each bidder shall make note of the existing conditions affecting hauling, rigging transportation, installation, etc., in connection for his work and shall make all provisions for transportation such of all materials and equipment.

D. Where field conditions require, the Electrical Contractor shall arrange for equipment to be shipped to the job, dismantled and assembled in place.

1.18 PAINTING

A. All finish field painting shall be provided by the General Contractor.

1.19 REFERENCE STANDARDS

A. The latest published issue of the standards, recommendations, or requirements of the following listed societies, associations, or institutes in effect at the date of Contract are part of this Specification. These shall be considered as minimum requirements; specific requirements of this specification and/or associated drawings shall have precedence. In case of conflict between published requirements, the Engineer and/or Owner's representative shall determine which is to be followed.

B. Electrical equipment, installation and workmanship shall conform to the latest editions of the applicable codes and standards of the following organizations.

1. Institute of Electrical and Electronic Engineers (IEEE)

2. American National Standards Institute (ANSI)

3. Massachusetts and National Electrical Code (MEC/NEC)

4. Underwriters' Laboratories (UL)

5. National Bureau of Standards (NBS)

   a. H33-Safety Rules-Electrical Utilization Equipment.
   b. H51-Safety Rules-Installation and Maintenance of Electric Supply and Communication Lines.

6. National Electrical Manufacturers Association (NEMA)

7. American Society for Testing and Materials (ASTM)

8. Insulated Power Cable Engineers Association (IPCEA)

9. Occupational Safety and Health Act (OSHA)

1.20 COOPERATION WITH OTHER TRADES

A. The work shall be so performed that the progress of the entire building construction, including all other trades, shall not be delayed or interfered with. Materials and apparatus shall be installed as fast as conditions of the building will permit and must be installed promptly when and as desired.

B. Confer with all other trades relative to location of all apparatus and equipment to be installed and select locations so as not to conflict with work of other Sections. Any conflicts shall be referred immediately to the Engineer for decision to prevent delay in installation of work. All work and materials placed in violation of this clause shall be readjusted to the Engineer's satisfaction, at no expense to the Owner.

C. Where work of this section will be installed in close proximity to work of other sections or where there is evidence that the work of this section will interfere with work of other sections, assist in working out space conditions to make satisfactory adjustment. If so directed by the Engineer, prepare and submit for approval 1/8" scale or larger working drawings and sections, clearly showing how this work is to be installed in relation to the work of other sections. If the work of this section is installed before coordinating with other trades or so as to cause interference with work of other trades, make changes necessary to protect conditions without extra charge.

1.21 WORKING CONDITIONS AND SAFETY

A. Whereas the building may be occupied during the construction period, it is of utmost importance for occupant's safety and that the building functions be maintained. The Electrical Contractor shall not disrupt the normal operations of the building and shall be required to cease work during occupied hours if, in the opinion of the Owner's Representative or the Engineer, the work creates a disruption. The Electrical Contractor will then be required to perform such disruptive work during unoccupied business hours. No work shall commence until the site has been properly prepared.

1.22 MATERIAL AND WORKMANSHIP

A. All material provided shall be new and approved for the intended service.

B. Defective equipment or equipment damaged in the course of installation or testing shall be replaced by the Electrical Contractor at no cost to the Owner.

C. All work shall be executed in the best and most thorough manner known to each trade. Employ careful, competent, experienced journeymen, and insofar as possible, keep the same foreman and workmen from the beginning to the completion of the job.

1.23 PRODUCT HANDLING AND STORAGE

A. Arrange for, and provide, a storage space or area at the job site for all electrical equipment and materials to be installed or reinstalled in the project. The exact location of portable storage vans at the job site or protected storage areas within the building construction, conditions permitting, shall be arranged with the Engineer.

B. All electrical equipment and materials, upon receipt at the job site shall be thoroughly inspected as to their type and condition and the quantity received.

C. After inspection, all electrical equipment and materials shall be moved to the storage area designated.

1.24 OUTAGES

A. The Electrical Contractor shall coordinate all power outages with Owner's Representative.

B. Outages confined to the mechanical equipment shall be coordinated with the general contractor.

1.25 HOISTING, SCAFFOLDING, STAGING AND PLANKING

A. Provide, set up and maintain all required derricks, hoisting, machinery, scaffolding, staging and planking for the work of this section.

B. Scaffolding is to have solid backs and floors to prevent dropping materials to the floors or ground.

PART 2 - MATERIALS

2.01 RACEWAYS AND FITTINGS

A. General:

1. All wiring shall be installed in conduit or wireways, unless otherwise indicated. All conduits shall be minimum 3/4" commercial trade size, unless otherwise specified or indicated on the drawings. Metallic conduit fittings shall be made of steel or malleable iron only. Die-cast zinc-alloy fittings and fitting made of inferior materials, such as “pot metal”, shall not be used.

B. Rigid Steel Conduit:

1. Rigid Steel, Galvanized

a. Full weight galvanized steel conforming with UL 6 and ANSI C80.1.

2. Terminations

a. Double locknutted with insulated throat bushings in dry locations.
b. Insulated, gasketed hub connectors in damp/wet locations.

3. Fittings and Conduit Bodies

a. Fittings and conduit bodies: ANSI/NEMA FB 1; threaded type, material to match conduit.

C. Electrical Metallic Tubing (EMT)

1. Zinc coated steel conforming to industry standards, NEMA TL2, by Republic Steel, Allied Tube or approved equal.

D. Liquid-Tight Flexible Metal Conduit

1. Flexible galvanized steel tubing over which is extruded a liquid-tight jacket of polyvinyl chloride (PVC) 1-1/4" size and smaller shall be provided with a continuous copper bonding conductor.

2. Connectors shall be steel or malleable iron with insulated throats.

E. Wireways

1. Wireways, auxiliary gutters, and associated fittings shall comply with UL 870.

2. Wireways shall be of the screw-cover type, and of sizes indicated or as required by NEC.

3. Wireways shall be of raintight construction in wet locations.

4. Finish shall be paint, manufacturer's standard.

2.02 OUTLET BOXES

A. Outlet boxes for exposed conduit work shall be cast aluminum alloy with cast aluminum alloy covers.

B. Switch boxes, receptacle boxes and other outlet boxes shall be standard 4" square with plaster rings or gang covers as required.

C. Outlet boxes for various systems and components shall be as required by manufacturer.

D. Provide screw-joint outlet boxes, with gasketed weatherproof covers in locations, where exposed to moisture, or next to water or steam connections, and where indicated as weatherproof on Drawings.

E. Provide only enough conduit openings to accommodate conduits at individual location. Each box shall be large enough to accommodate number and sizes of conduits, wires and splices to meet NEC requirements, but shall be at least size shown or specified. Necessary volume shall be obtained by using boxes of proper dimensions.

2.03 WIRING DEVICES

A. Receptacles:

1. Duplex receptacles shall be grounding straight blade, polarized slot type, NEMA 5-20 configuration. Ratings shall be 125 volts AC, 20 amperes. Receptacles shall be constructed of high impact plastic, color to match existing. Contacts shall be of the triple wipe type. Side screw terminals shall accept #10 or #12 AWG copper wire. Two each terminals shall be provided for line and neutral and a single green colored terminal for the grounding conductor. Receptacles shall be heavy duty, specification grade, self-grounding, Federal Specification W-C-596.

2. Where standard duplex receptacles are provided in the same location (within 8 feet) as GFI type duplex receptacles, the standard receptacle(s) shall be similar in configuration as the GFI receptacle, such as Pass & Seymour "Sierra plex", Leviton "Decora", Hubbell "Style-line" or approved equal.

B. Switches:

1. Switches shall be single pole, double pole, three way or four-way configuration as indicated on the plans. Switch contact ratings shall be 120 volts AC, 20 amperes. Switches shall have line and load screw terminals and a single green grounding screw terminal to accept up to #10 AWG copper wire. The switch body shall be constructed of high-impact resistant plastic, color to match existing. Switches shall be of the quiet type with toggle type handles. Single and double pole switches shall have embossed "on" and "off" markings on the toggle. Switches shall meet federal specification W-S-896(e) and UL20, and be heavy duty, specification grade.

2.04 WIRING DEVICE PLATES

A. Provide device plates by Arrow-Hart, Bryant, Hubbell or approved equal. One-piece type device plates shall be provided for all outlets and fittings. Plates on unfinished walls and on fittings shall be of zinc-coated sheet steel, cast-metal, or impact resistant plastic having rounded or beveled edges. Plates on finished walls shall be of steel with baked enamel finish. Screws shall be of metal with countersunk heads, in a color to match the finish of the plate.

B. Device plates for shut off switches and manual motor starters shall have engraved nameplates in 1/4" letters.

C. Device plates shall be manufacturer of wiring devices.

2.05 DEVICE, PULL AND JUNCTION BOXES

A. The Electrical Contractor shall provide junction boxes, pull boxes, terminal boxes and fittings as indicated on drawings, specified herein or wherever necessary to facilitate pulling or splicing of wires and cables of all electrical systems, and/or required by code.

B. Junction or pull boxes not over l00 cubic inches in size shall be standard outlet boxes, except as noted otherwise. Junction and pull boxes over l00 cubic inches in size shall be constructed of code gauge sheet steel with screw covers and gaskets and shall be fabricated from approved detailed working drawings. Finish shall be paint over zinc chromate primer.

C. Outlet boxes in unfinished areas shall be cast metal with threaded conduit hubs.

D. Outlet boxes for receptacles shall be of galvanized steel at least 2" deep and of sufficient size to accommodate devices at outlet location. All boxes shall have mounting lugs or ears for covers and knockouts for raceway termination.

2.06 WIRE AND CABLE

A. Wire and cable of sizes, quantities and types shown on drawings, schedules or specified herein shall be provided by the Electrical Contractor. All wire and cable shall be installed in raceways, unless otherwise indicated.

B. Wire and cable work shall be in strict accordance with requirements of National Electrical Code and its latest revisions, both with respect to material and workmanship, except where insulation thickness and covering are required by these Specifications in excess of Code requirements.

C. Minimum size wiring, unless otherwise indicated, for power branch circuit shall be #12 AWG.

D. Branch circuit power, and control wiring, except as otherwise noted, shall have type THWN-THHN, 600 volts insulation. Unless otherwise noted, feeder wiring and branch circuit wiring sizes #6 AWG AND LARGER shall be Type XHHW, #8 AWG and smaller type shall be THWN-THHN.

E. Wires and cables shall be single conductor. Conductors of sizes #8 AWG and larger shall be stranded; wires smaller than #8 AWG shall be solid. Conductors shall be soft drawn copper and have a conductivity of not less than 98 percent of ASTM standards for annealed copper. Aluminum conductors will not be accepted.

F. Sizes 12 and 10 AWG wire and cable shall be factory color-coded with a separate color for each phase of each system voltage used consistently throughout power systems. Size 8 AWG and larger shall be completely colored with vinyl tape wherever accessible. Colors shall be in accordance with those listed in Section 3 of this specification.

G. Grounding conductors and equipment grounds unless bare, shall have a GREEN covering or shall be completely marked with green tape at boxes, conduit bodies or where otherwise accessible.

H. Cables ties and straps shall be self-clinching types of one piece molded construction. Bodies shall be of nylon and clinching clips shall be spring bronze. Ties and straps shall be Thomas & Betts Company, Types TY-25 and TY-35 or approved equal.

2.07 WIRE PULLING EQUIPMENT

A. Provide polyethylene ropes for pulling wire.

B. Provide fish wires in all empty conduit systems required, without splices and with ample exposed lengths at each end.

C. Provide wire pulling lubricants that meet applicable UL requirements as necessary.

2.08 DISCONNECT SWITCHES

A. All safety switches shall be NEMA type “HD”, heavy duty and shall meet or exceed NEMA Standard KS-1 for type HD switches, and meet or exceed Federal Specification W-S-865C for HD switches.

B. Enclosed disconnect switches shall have the following features:

1. Quick-make, Quick-break Switch Mechanism

2. Padlockable Door and Handle

3. Positive Type Interlocked Door

4. 250-volt AC Rating

5. Visible On-off Indication

6. NEMA 3R Surface Enclosure in Wet Locations

7. CO/ALR Cable Lugs

8. Horsepower Rated (note that HP rating of switch must be equal to or greater than HP rating of motor or equivalent equipment loads.

2.09 FUSES

A. Provide current-limiting, high-interrupting-capacity fuses for equipment provided under this and other Sections.

B. Fuses 600 Amp and smaller that serve motors, shall be dual-element current limiting Class RKI or approved equal.

C. Submit specific fuse locations, types, manufacturers and ratings.

D. Switch sizes and fuse ratings shown on Drawings and specified represent general approximate values for each motor hp delineated. Coordinate fuse values with motor switch sizes. Obtain recommended fuse rating data from the fuse manufacturer. In case of discrepancy between Contract Documents and manufacturer's recommendations, manufacturer's recommendations, shall govern work. Revise switch sizes to accommodate recommended fuse values and revise assembled equipment as necessary. Furnish necessary change information to equipment manufacturers. Submit changes in switch sizes to Architect for approval. Certify that motor circuits have adequate short circuit protection with fuses provided.

2.10 WALL PLATES

A. Single and combination types to match corresponding wiring devices and existing conditions.

1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting

3. Material for Unfinished Spaces: Match existing.

4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.11 PANEL BOARDS AND CIRCUIT BREAKERS

A. Provide UL-listed safety dead-front lighting and power panel boards where shown on the drawings and as scheduled. Panel boards shall meet or exceed requirements of NEMA Standard Publication PB-1, and UL-50 and 67. Provide cabinets with flush hinges and combination catch and lock. Provide wiring gutters to accommodate large multiple feeder cables and lugs. Except as shown otherwise on the Drawings, wiring gutters shall be at least 4" for lighting panels.

B. Provide molded case, bolt-on, thermal-magnetic trip, single, two or three pole branch circuit breakers as shown on the Drawings. Multiple pole breakers shall be single handle, common trip.

C. Main bus work of panels shall carry at least full rating of feeder overcurrent devices that supply the panel.

D. Provide separate equipment ground bus for each panel board.

E. Power and lighting panels shall have heavy -duty, continuous, section vertical-hinged to box section for access to wiring gutters in addition to trim door. Increase size of panel board gutters to accommodate compression connectors for aluminum conductors.

F. Panel boards shall have integrated short circuit current rating equal to or greater than circuit breaker AIC ratings scheduled on the Drawings.

G. Panels shall be by Square D, Type NQOB for 225A and below, and I-Line distribution for 400A and above, or approved equal by Siemens, Eaton, or GE.

H. Provide surface metal tubs ready for painting.

I. Provide bus connections for future overcurrent device with suitable insulation and bracing to maintain proper short circuit rating and voltage clearances, where required on the Drawings. Provide for ready insertion of future breakers.

J. Main bus bars shall be copper, sized as required by UL standards to limit temperature rise on current-carrying parts to 50°C above ambient 40°C maximum.

K. Provide typed panel circuit directories that show use of each circuit and electrical characteristics of the panel board.

2.12 GROUNDING

A. Cables shall be of solid or stranded copper size as specified on the drawings. Cables shall be bare when installed in soil or in open air, and shall be insulated with 600 volt green jackets in all runs installed in conduit.

B. The grounding conductor bonding jumper shall be attached to the circuits, conduits, cabinets, equipment and the like, which are to be grounded by means of suitable lugs, pressure connectors and clamps.

C. All feeder and three phase motor circuits shall be provided with an appropriately sized grounding conductor. Sizes shall be based on NEC Table 250-95. Grounding conductors shall also be provided wherever the raceway is not a suitable grounding conductor.

2.13 IDENTIFICATION

A. Wire and Cable Identification

1. Conductor labels shall be white, adhesive self-laminating type. All text shall be typed. String tags shall not be accepted. Temporary tagging during construction shall be allowed, but all permanent adhesive tags shall be in place prior to requesting final acceptance.

2.14 LIGHTING FIXTURES

A. All Luminaires

1. Comply with IES LM-79-08 Approved Method for measuring lumen maintenance of LED light sources.

2. Comply with IES LM-80-08 Approved Method for electrical and photometric measurement of SSL product.

3. LED's shall be Restriction of Hazardous Substances Directive (RoHS) compliant.

4. LED arrays shall be sealed, high performance, long life type; minimum 70% rated output at 50,000 hours.

5. LED luminaires shall deliver a minimum of 60 lumens per watt.

    a. LED's shall be "Bin No. 1" quality

6. Drivers shall be solid state and accept 120 through 277 VAC at 60 Hz input.

7. The LED light source shall be fully dimmable with use of compatible dimmers switch designated for low voltage loads.

8. LED color temperatures: CRI> 85, 2700K as noted +/- 145K.

9. LED color temperatures: CRI> 85, 3000K as noted +/- 275K.

10. Luminaires shall have internal thermal protection.

11. Luminaires shall not draw power in the off state. Luminaires with integral occupancy, motion, photo-controls, or individually addressable luminaires with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.

12. Color spatial uniformity shall be within .004 of CIE 1976 diagram.

13. Color maintenance over rated life shall be within .007 of CIE 1976.

14. Indoor luminaires shall have a minimum CRI of 85.

15. Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management

16. LED package(s)/module(s)/array(s) used in qualified luminaires shall deliver a minimum 70% of initial lumens, when installed, for a minimum of 50,000 hours.

17. Luminaires shall be fully accessible from below ceiling plane for changing drivers, power supplies and arrays.

B. Power Supplies and Drivers

1. Power Factor: 0.90 or higher

2. Maximum driver case temperature not to exceed driver manufacturer recommended operation.

3. Output operating frequency: 60Hz.

4. Interference: EMI and RFI compliant with FCC 47 CFR Part 15.

5. Total Harmonic Distortion Rating: 20% Maximum.

6. Meet electrical and thermal conditions as described in LM-80 Section 5.0.

7. Primary Current: Confirm primary current with Drawings.

8. Secondary Current: Confirm secondary current specified by individual luminaire manufacturers.

9. Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified control components.

10. Solid-state control components to be integral or external per each specified luminaire. Remote control gear to be enclosed in Class 1, Class 2, or NEMA 3R enclosures as required.

C. Controller and Control System

1. System electronics driver / controller to use coordinated communication protocols: 0-10V, or proprietary as required

2. The Contractor to ensure that external control equipment is compatible with LED control requirements

3. Provide connector types and wiring as appropriate for un-interrupted communication between devices, considering distance maximums, field obstructions, and accessibility. Ensure that connection points are optically isolated for system noise reduction.

D. Lighting fixtures and equipment of the exact type and quality specified and indicated on Drawings and Schedules shall be provided in order to achieve quality and levels of illumination incorporated in the lighting design. Any substitution submittals shall include a point-by-point analysis, provided by the fixture manufacturer, for this particular application. Generic photometric data will not be accepted to meet this requirement.

2.15 FIRE ALARM SYSTEM

A. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for Local Protected Premises Signaling Systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.

1. The Secondary Power Source of the fire alarm control panel will be capable of providing at least 24 hours of backup power with the ability to sustain 5 minutes in alarm at the end of the backup period.

2. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.

3. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof).

4. Underwriters Laboratories Inc. (UL) - USA:

a. UL 38 Manually Actuated Signaling Boxes

b. UL 228 Door Closers–Holders for Fire Protective Signaling Systems

c. UL 268 Smoke Detectors for Fire Protective Signaling Systems

d. UL 268A Smoke Detectors for Duct Applications

e. UL 464 Audible Signaling Appliances

f. UL 521 Heat Detectors for Fire Protective Signaling Systems

g. UL 864 Standard for Control Units for Fire Protective Signaling Systems

h. UL 1481 Power Supplies for Fire Protective Signaling Systems

i. UL 1638 Visual Signaling Appliances

5. The FACP shall be ANSI 864, 9th Edition Listed. Systems listed to ANSI 864, 8th edition (or previous revisions) shall not be accepted.

B. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final check-out and to ensure the systems integrity.

C. Scope

1. An intelligent, microprocessor-controlled, fire alarm detection system shall be installed in accordance to the project specifications and drawings.

2. Basic Performance:

a. Initiation Device Circuits (IDC) shall be wired NFPA Style B (Class B) as part of an addressable device connected by the SLC Circuit.

b. All circuits shall be power-limited, per UL864 requirements.

c. A single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm. Alarm signals arriving at the main FACP shall not be lost following a primary power failure or outage of any kind until the alarm signal is processed and recorded.

3. Panel shall meet requirements of UL-864 Ninth Edition.

D. Quality Assurance

1. Each and every item of the Fire Alarm System shall be listed as a product of a single fire alarm system manufacturer under the appropriate category of Underwriter's Laboratories (UL) and shall bear the UL label. Catalog numbers and operations specified are those of FIRE CONTROL INSTRUMENTS (FCI) as supplied by MAMMOTH FIRE ALARMS, INC. and indicate the quality and type of equipment to be furnished and installed. Other acceptable manufacturers are Notifier and EST or approved equal:

E. Basic System Functional Operation

1. When a fire alarm condition is detected and reported by one of the systems initiating devices, the following functions shall immediately occur:

a. The Zone Alarm LED for the particular zone in alarm shall light.

b. A local sounder with the control panel shall sound.

c. In response to a fire alarm condition, the system will process all control programming and activate all system outputs (alarm notification appliances and/or relays) associated with the point(s) in alarm. Additionally, the system shall send events to a central alarm supervising station via cellular communicator.

F. Maintenance

1. Maintenance and testing shall be on a semi-annual schedule or as required by the local AHJ. A preventive maintenance schedule shall be provided by the contractor describing the protocol for preventive maintenance. The schedule shall include:

a. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, and all accessories of the fire alarm system.

b. Each circuit in the fire alarm system shall be tested semi-annually.

c. Each smoke detector shall be tested in accordance with the requirements of NFPA 72.

2. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, tests, and repairs described below. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guarantee.

G. Post Contract Expansions

1. The contractor shall have the ability to provide parts and labor to expand the system specified, if so requested, for a period of five (5) years from the date of acceptance.

2. As part of the submittal, include a quotation for all parts and material, and all installation and test labor as needed to increase the number of intelligent or addressable devices by ten percent (10%). This quotation shall include HFS or equivalent Fire•Lite intelligent smoke detectors, HFS or equivalent Fire•Lite intelligent heat detectors, addressable manual stations and HFS or equivalent Fire•Lite addressable monitor modules equal in number to one tenth of the number required to meet this specification (list actual quantity of each type).

3. The quotation shall include installation, test labor, and labor to reprogram the system for this 10% expansion. If additional FACP hardware is required, include the material and labor necessary to install this hardware.

4. Do not include cost of conduit or wire or the cost to install conduit or wire except for labor to make final connections at the FACP and at each HFS or equivalent Fire•Lite intelligent addressable device. Do not include the cost of conventional peripherals or the cost of initiating devices connected to the addressable monitor/control modules.

5. Submittals that do not include this estimate of post contract expansion cost will not be accepted.

H. Equipment and Material, General

1. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a fire protective signaling system, meeting the National Fire Alarm Code.

2. All equipment and components shall be installed in strict compliance with manufacturers recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

3. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

4. All equipment must be available "over the counter" through the Security Equipment Distributor (SED) market and can be installed by dealerships independent of the manufacturer.

I. Wire

1. All fire alarm system wiring shall be new.

2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.

3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.

4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NEC 760 (e.g., FPLR).

5. Wiring used for the multiplex communication circuit (SLC) shall be twisted non-shielded and support a minimum wiring distance of 10,000 feet when sized at 12 AWG.

6. All field wiring shall be electrically supervised for open circuit and ground fault.

7. The fire alarm control panel shall be capable of T-tapping NFPA Style 4 (Class B) Signaling Line Circuits (SLCs). Systems which do not allow or have restrictions for the numbers of T-taps, length of T-taps etc., are not acceptable.

J. Terminal Boxes, Junction Boxes and Cabinets:

1. All boxes and cabinets shall be UL listed for their use and purpose.

K. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold-water pipe or grounding rod.

1. The FACP shall be capable of coding Notification Appliance Circuits in Temporal (NFPA 72) or Constant On (24 VDC power). Main panel notification circuits (NACs 1 & 2) shall also automatically synchronize any of the following manufacturer's notification appliances connected to them: System Sensor, Wheelock, Gentex or Amseco with no need for additional synchronization modules.

L. Main Fire Alarm Control Panel

1. The FACP shall be equal to a Fire-Lite Model ES-50X and shall contain a microprocessor-based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: HFS or equivalent Fire•Lite intelligent addressable smoke and HFS or equivalent Fire•Lite thermal (heat) detectors, HFS or equivalent Fire•Lite addressable modules, annunciators, Cellular Communicator and Ethernet Communicators and other system-controlled devices. Ethernet communications shall be via a Fire-Lite Model IPDACT or approved equal.

2. Operator Control

1) Acknowledge Switch:

2) Activation of the control panel Acknowledge switch in response to new alarms, supervisory and/or troubles shall silence the local panel piezo electric signal and change the alarm, supervisory and trouble LEDs to steady-ON mode.
3) Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.

3. Alarm Silence Switch:

a. Activation of the alarm silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The election of notification circuits and relays that are silence-able by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.

4. Alarm Activate (Drill) Switch:

a. The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is reset.

5. System Reset Switch:

a. Activation of the System Reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.

6. Lamp Test:

a. The System RESET switch shall also function as a Lamp Test switch and shall activate all system LEDs and light each segment of the display.

7. System Capacity and General Operation

a. The control panel shall provide, or be capable of, expansion to 50 intelligent/addressable devices of any type, detector or module.

b. The control panel shall include two Form-C programmable relays, which can be used for Alarm, and Supervisory and a fixed Trouble relay rated at a minimum of 2.5 amps @ 24 VDC. It shall also include 2 programmable Notification Appliance Circuits (NACs) capable of being wired as NFPA Style Y (Class B). Either programmable Notification circuit shall also be capable of providing auxiliary power when programmed as such.

c. The control panel must have a built-in annunciator with three characters of display each consisting of seven segments and feature LED's for AC, General Trouble, Silenced, Ground Fault, Low Battery, Walk Test, NAC 1 and 2 Active and Trouble, and Zones 1 through 5 Alarm, Supervisory, and Trouble. All control and programming keys are a membrane style buttons. The annunciator must be able to silence and reset alarms by opening the cabinet door and pressing SILENCE or RESET once. The annunciators must have an installer code that will allow the limitation of operating system programming to authorized individuals.

d. Modifications to the default panel program can only be accomplished using the embedded web server of the control panel. There are two ways to connect to the panel: connected to an existing network with a DHCP Dynamic Host Configuration Protocol) server present or plugged in directly to a PC using a standard CAT5e Ethernet cable.

e. The system shall allow the programming of any input to activate any output.

f. The FACP shall provide the following features:

1) Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out. Detector sensitivity test, meeting requirements of NFPA 72, Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.

2) Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification an excessive number of times.

3) Periodic detector test, conducted automatically by the software.

4) Walk test mode shall be a standard feature of the fire alarm control panel. The walk test feature shall function so that each alarm input tested will operate the associated notification appliance for three seconds. The FACP will then automatically perform reset and confirm normal device operation.

8. Central Microprocessor

a. The microprocessor shall be a state-of-the-art; it shall communicate with, monitor and control all external interfaces. It shall include non-volatile memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.

b. The microprocessor shall contain and execute all specific actions to be taken in the condition of an alarm. Control programming shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.

c. An auto-programming capability (JumpStart) shall be provided to quickly identify devices connected on the SLC and make the system operational.

9. Display

a. The display shall provide all the controls and indicators used by the system operator.

b. The display shall include status information for all intelligent detectors, addressable modules and zones.

c. The display shall contain dedicated LEDs for the annunciation of AC POWER, FIRE ALARM, SUPERVISORY, TROUBLE and GROUND FAULT, LOW BATTERY, and WALKTEST conditions.

d. The keypad shall be part of the standard system and have the capability to command all system functions. Installer password level shall be provided to prevent unauthorized system control or programming.

e. The display shall include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, DRILL (alarm activate), ALARM ID, SUPERVS ID, TROUBLE ID and SYSTEM RESET.

10. Signaling Line Circuit (SLC)

a. The SLC interface shall provide power to and communicate with up to 50 devices of any type including: intelligent detectors (photoelectric or thermal) addressable pull stations, intelligent modules (monitor control). Each SLC shall be capable of NFPA 72 Style 4 (Class B) wiring.

b. The CPU shall receive information from all intelligent detectors to be processed to determine whether normal, alarm or trouble conditions exist for each detector. The software shall automatically compensate for the accumulation of dust in each detector up to allowable limits. The information shall also be used for automatic detector testing and for the determination of detector maintenance conditions.

c. The detector software shall meet NFPA 72, requirements and be certified by UL as a calibrated sensitivity test instrument.

11. The control panel will have the capability of Reverse Polarity Transmission or connection to a Municipal Box for compliance with applicable NFPA standards.

12. Enclosures:

    a. The control panel shall be housed in a UL-listed cabinet suitable for surface mounting.

    b. The cabinet and front shall be corrosion protected and painted red via the powder coat method with manufacturer's standard finish.

    c. The back box and door shall be constructed of steel with provisions for electrical conduit connections into the sides and top.

    d. The door shall provide a key lock and shall provide for the viewing of all indicators.

13. Field Charging Power Supply:

    a. The FCPS is a device designed for use as either a remote 24-volt power supply or as a booster for powering Notification Appliances.

    b. The FCPS shall offer up to 8.0 amps (6.0 amps continuous) of regulated 24-volt power. It shall include an integral charger designed to charge 18.0-amp hour batteries.

    c. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a control relay.

    d. Four NAC outputs, wired NFPA Style Y, shall be available for connection to the Notification devices.

    e. The FCPS shall optionally provide synchronization of all connected strobes or horn strobe combinations when System Sensor, Wheelock or Gentex devices are installed.

    f. The FCPS shall function as a sync follower as well as a sync generator.

    g. The FCPS shall include a surface mount backbox.

    h. The Field Charging Power Supply shall include the ability to delay the reporting of an AC fail condition per NFPA requirements.

14. The FCPS shall provide 24 VDC regulated and power-limited circuitry per UL standards.

15. Power Supply:

    a. The main power supply for the fire alarm control panel shall provide up to 2.0 amps of available power for the control panel and peripheral devices.

    b. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.

c. The power supply shall provide an integral battery charger or may be used with an external battery and charger systems. Battery arrangement may be configured in the field.

d. The main power supply shall continuously monitor all field wires for earth ground conditions.

e. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.

16. Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:

a. The maximum pulse duration shall be 2/10 of one second.

b. Strobe intensity shall meet the requirements of UL 1971.

c. The flash rate shall meet the requirements of UL 1971.

17. Audible/Visual Combination Devices:

a. Shall meet the applicable requirements of UL 464 Audible Signaling Appliances for audibility.

b. Shall meet the requirements of UL 1638 Visual Signaling Appliances for visibility.

18. Specific System Operations

a. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently programmed for verification of alarm signals. The alarm verification time period shall not exceed 250 seconds.

b. Zone Disable: Any addressable device in the system may be enabled or disabled through the system keypad.

c. Zone Read: The system shall be able to display the following point status:

1) Alarm ID

2) Supervisory ID

3) Trouble ID

d. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

e. The fire alarm control panel shall include Silent and Audible Walk Test functions. It shall include the ability to test initiating device circuits and Notification Appliance Circuits from the field without returning to the panel to reset the system. The operation shall be as follows:

1) Alarming an initiating device shall activate programmed outputs, which are selected to participate in Walk Test.

f. Supervisory Operation: An alarm from a supervisory device shall cause the appropriate indication on the control panel display, light a Zone supervisory LED.

g. Signal Silence Operation: The FACP shall have the ability to program each output circuit (notification circuit or relay) to deactivate upon depression of the Signal Silence switch.

M. System Components

1. Addressable Pull Box (manual station)

a. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.

b. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.

c. Manual pull stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

2. Intelligent Photoelectric Smoke Detector

a. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

b. Detector shall be provided on a twist-lock base.

c. It shall be possible to perform a calibrated sensitivity and performance test on the detector without the need for the generation of smoke. The test method shall test all detector circuits.

d. A visual indication of an alarm shall be provided latching Light Emitting Diode (LED), on the detector, which may be seen from ground level over 360 degrees. These LED shall periodically flash to indicate that the detector is in communication with the control panel.

e. All field wire connections shall be made to the base through the use of a clamping plate and screw.

3. Addressable Dry Contact Monitor Module

a. Addressable monitor module shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any normally open dry contact device) to one of the fire alarm control panel SLCs.

b. The IDC zone shall be suitable for Style B (Class) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

4. Addressable Control Relay Module

a. Addressable control relay modules shall be provided to control the operation of auxiliary control functions.

b. The control module shall mount in a standard 4-inch square, 2-1/8-inch-deep electrical box, or to a surface mounted backbox.

c. The control relay module will provide a dry contact, Form-C relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% of all auxiliary relays may be energized at the same time on the same pair of wires.

d. The control relay module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

5. Alphanumeric LCD Type Annunciator:

a. The alphanumeric display annunciator shall be a supervised, remotely located back-lit eighty (80) characters LCD display for alarm annunciation in clear English text.

b. The LCD annunciator shall display all alarm and trouble conditions in the system.

c. An audible indication of alarm shall be integral to the alphanumeric display.

d. The display shall be UL listed for fire alarm application.

e. It shall be possible to connect up to 2 LCD displays and be capable of wiring distances up to 6,000 feet from the control panel.

f. The annunciator shall connect to a separate, dedicated "terminal mode" EIA-RS-485 interface using two-wire loop connection and 2 wires for power. Each terminal mode LCD display shall mimic the main control panel.

6. Field Wiring Terminal Blocks

   a. For ease of connection for heavy solid gauge wire, all panel I/O wiring terminal blocks shall be screw type barrier strips and have sufficient capacity for #22 to #12 AWG wire.

N. System Components - Addressable Devices

1. Addressable Devices - General

   a. Addressable devices shall employ the simple-to-set decade addressing scheme. Addressable devices which use a binary-coded address setting method, such as a rotary dial.

   b. Detectors shall be addressable and intelligent, and shall connect with two wires to the fire alarm control panel signaling line circuits.

   c. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.

   d. Detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.

   e. Detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel.

O. Batteries

1. Upon loss of Primary (AC) power to the control panel, the batteries shall have sufficient capacity to power the fire alarm system for required standby time (24 hours) followed by 5 minutes of alarm.

2. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.

PART 3 - EXECUTION

3.01 RACEWAYS AND FITTINGS

A. Conduits usage shall be as follows:

LOCATION	EXPOSED/ CONCEALED	SUBJECT TO DAMAGE, Y/N	WET/DAMP OR DRY	PERMITTED CONDUITS
Interior	Exposed	No	Dry	RGS/EMT
Interior	Exposed	Yes	Dry	RGS
Interior	Exposed	No	Wet	RGS
Exterior	Exposed	Yes	Wet	RGS
Exterior	Exposed	No	Wet	RGS

*RGS - Rigid Galvanized Steel
*EMT – Electrical Metallic Tubing

B. All conduits shall be cut square and reamed at the ends. All joints shall be drawn tight. Exposed conduit shall be run parallel to or at right angles to the lines of the building. Right angle bends in exposed conduit shall be made with standard elbows, conduit body fittings, or conduit bent to radii not less than those of standard elbows. All bends shall be free from dents or flattening.

C. Conduit shall be made mechanically and electrically continuous from service entrance to all outlets.

D. Conduit connected to wall outlets shall be run in such a manner that they will not cross water, steam or waste pipes wherever possible. Overhead conduits shall be run above water, steam or waste lines wherever possible.

E. Liquid-tight flexible conduits shall be used for connection to motors and other electrical equipment when it is subject to movement, vibration, misalignment or cramped quarters or where noise transmission is to be eliminated or reduced. Proper angle connectors (straight, 45 degree, 90 degree) shall be used for the installation. Improperly installed connectors are not allowed.

F. Pipe straps and hanger rods shall be fastened to concrete by means of inserts or expansion bolts, to brickwork by means of expansion bolts and to hollow masonry by means of toggle bolts. Hanger rods shall be fastened to beams and joists by means of swivel type beam clamps. Wooden plugs and shields and powder driven fasteners shall not be used.

G. Individual horizontal conduits shall be supported by one hole pipe straps or separate pipe hangers for sizes 1-1/2" and smaller. Spring steel fasteners may be used for sizes 1-1/2" and smaller in dry locations only. Hanger rods used with spring steel fasteners shall be minimum 1/4" diameter.

H. Where two or more horizontal conduits run parallel and at the same elevation, they shall be supported on multiple pipe hangers. Conduit shall be secured to the horizontal hanger member.

I. Pull boxes shall not be utilized for the vertical support of conduits.

J. Every conduit system shall be installed complete and blown through and swabbed before conductors are installed.

K. Wireways shall be used for mounting groups of disconnects and/or starters, or where shown on the drawings.

3.02 DEVICE, PULL AND JUNCTION BOXES

A. Boxes shall be installed in rigid and satisfactory manner supported by bar hangers in frame constructions or fastened directly with wood screws on wood; bolts to hollow expansion shields on concrete or brick, toggle bolts on hollow masonry units and machine screws or welded threaded studs on metal. Threaded studs provided with lock washers and nuts are acceptable for mounting of outlets on concrete construction.

B. Location of devices shown on the Drawings is approximate. When necessary, devices shall be relocated at no extra cost within a 10'-0" radius to avoid conflicts with structural conditions or equipment of other trades. Outlets shall be symmetrically located according to room layouts.

C. Boxes shall be secure to conduit by means of double steel locknuts (inside and outside) and malleable iron or steel insulated throat bushings. Covers on fire alarm system junction and pull boxes shall be painted RED with nameplates.

3.03 WIRE AND CABLE

A. 250 Volt Systems:

1. Conductors shall not be installed in a manner which will injure their insulation or covering. Conduit system shall be complete before any conductors are installed. Conductors shall not be installed until such time that the conductors can be suitably protected against the elements and damage.

2. Provide and use suitable cable pulling winches or equipment of adequate capacity in order to insure a steady, continuous pull. Before any wires or cables are drawn into conduits, the conduit shall be cleaned out by pulling a swab through the conduit with fish tape, and wires shall be pulled through conduit in such a manner as to avoid kinking or injuring the insulation. Only non-metallic approved cable lubricants shall be used when necessary. Cable lubricants shall be completely removed at panelboards, pull and junction boxes and other accessible locations.

3. All feeder cables shall be continuous from origin to panel or equipment termination without running splices in intermediate pull or splice boxes. Where taps and splices are deemed necessary by job conditions, they shall first be approved by the Engineer and shall be made in approved splice boxes with suitable connectors as noted herein.

4. No splices or joints shall be permitted in branch circuits except within accessible junction boxes. Splices in junction boxes shall be with enough spare wire to enable two or more splices to be remade with the same wire in event of a fault. When a bolted splice or connection presents an irregular surface, duct seal compound shall be molded around the joint. It shall make a smooth taping surface and prevent the formation of air pockets.

5. Use solderless pressure connectors on conductors of No. 8 AWG and larger and tape to provide insulation not less than that of the conductor. Solderless connectors shall be of rugged construction with multi-point contact on cable, ground contact surfaces for low resistance and low temperature rise, and with high pull-out strength. On conductors of 250 MCM or larger provide not less than 2 pressure connectors.

6. On conductor sizes No. 10 or smaller, connectors shall be molded composition with metal thread-on core.

7. At panelboards, junction boxes and conductors shall be identified with circuit numbers by applying suitable marking.

8. Neatly train all wiring within equipment boxes and panelboards.

9. Inspect all wire and cable for damage after installation. Replace all damaged conductors or insulation. Megger test all feeder conductors and record results in accordance with Section 01 70 00 of this specification. Verify all phasing of conductors and equipment.

10. Conductor color coding for power circuits shall be as follows:

Phase	120/208 volts
A	Black
B	Red
C	Blue
Neutral	White
Ground	Green

3.04 DISCONNECT SWITCHES

A. Provide manufacturer's nameplates for front cover indicating the following information:

1. Switch Type

2. Catalog Number

3. H.P. Rating

4. Voltage Rating

5. Current Rating

B. Install safety disconnect switches at all locations as shown on drawings. Disconnects shall be mounted within sight, and proximate to the load served. Disconnects are to be mounted 48" AFF, unless otherwise noted.

C. Provide engraved phenolic (white lettering/black field) nameplate indicating load being fed.

3.05 IDENTIFICATION

A. Equipment Identification:

1. All new and relocated electrical equipment shall be fitted with engraved plastic plates identifying the function of the equipment, and the load(s) served. The following electrical equipment shall be provided with engraved nameplates:

   a. Panelboards

   b. Disconnect Switches

   c. Motor Starters

2. Nameplates shall identify equipment as shown on the drawings. Panelboards shall be identified as designated on the plans, for example "PBE1". Electrical equipment which serves mechanical equipment shall be identified by the equipment name and tag number, for example, "Roof Top Unit 1, RTU-1".

3. Nameplates shall be affixed to electrical equipment by means of not less than two metal fasteners appropriate for the enclosure type and material. Adhesive mounting will not be allowed. Where engraved nameplates are installed on removable covers (e.g. motor starters) a typed adhesive label reading the same as the engraved label shall be affixed inside the fixed portion of the enclosure to avoid mixing covers and misidentifying-identifying equipment.

4. Prior to fabricating engraved nameplates, the Electrical Contractor shall submit a complete listing of all nameplates to be provided, for review by the Engineer. The submittal shall be in accordance with the General Conditions of the contract. The submittal shall show each nameplate in actual size with the text to be engraved.

5. All equipment identification shall be in place prior to requesting final inspection.

B. Wire and Cable Identification:

1. Wire and cable color codes shall be as listed in section 3.03 of this specification. Color codes shall be maintained throughout the entire length of a conductor.

2. All feeder and branch circuits shall be identified at both ends as to the source and destination of the circuit conductors.

3.06 LIGHTING FIXTURES

A. Lighting fixtures shall be installed in accordance with the Massachusetts State Building Code Seismic Requirements. This shall include but not be limited to supporting all fixtures from the structural supports with at least (2) opposite points. At no time shall a fixture be supported by a suspended ceiling grid or tile.

3.07 WIRING DEVICES

A. Conductors terminating in each wired outlet shall be left not less than 8 inches long at their outlet fitting to facilitate the installation of devices or fixtures. Where two or more pairs of conductors or circuits enter an outlet, the several pairs of circuits shall be neatly spliced and made mechanically and electrically secure to one or more single or multiple conductors.

B. Duplex Receptacles:

1. Duplex receptacles shall be mounted in outlet boxes, where shown on the plans. In finished areas, receptacle outlet boxes shall be flush. In unfinished dry areas, boxes shall be cast, Type FS, surface-mounted with suitable device holder/cover plate.

2. Duplex receptacles shall be side-wired. Back wiring shall not be accepted. A #12AWG grounding jumper shall connect the grounding terminal on the receptacle to the EGC, and the outlet box. Automatic grounding springs or clips shall not be the sole grounding method.

3. Duplex receptacles shall be mounted 18" AFF unless otherwise noted. Device plates shall be as specified under Part 2, Products. All receptacles shall be tested for proper polarity and grounding.

C. Device Plates:

1. Device plates shall be single or multiple gang, as required. Sectional or gang-able plates will not be accepted.

2. Device plates shall be installed level and plumb, and to cover the unfinished area around the box. Device plates shall be attached using the matching finish screws provided with the plate.

3.08 GROUNDING

A. The entire electrical wiring raceway system of this project shall be made to form a continuous, permanent and effective equipment grounding circuit which shall be installed as follows:

1. All metallic threaded couplings and conduits shall be wrench-tight.

2. All termination of rigid conduits at all boxes, cabinets, and other enclosures shall be made with double locknut arrangement and a bushing. Bushings shall be insulating type.

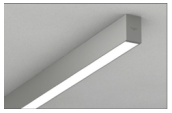
3. All flexible metallic conduit and liquid-tight flexible conduits over 6' long or with conductors carrying over 20 amps shall have proper size ground conductor jumper bonded to the rigid conduit system and to the electrical equipment.

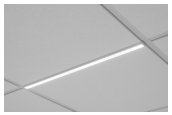
4. All electrical, metallic enclosures shall be effectively bonded by a separate green colored bonding screw. The use of a mounting screw for grounding will not be accepted.

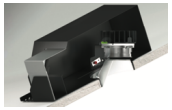
5. All sections of wiring gutters and wireways, all outlet boxes and receptacle grounding terminals, all metal sections of continuous rigid cable supports and fittings and cable bus, and other built-up enclosures with bolted joining of sections shall be firmly bonded and effectively grounded. Conduit expansion fittings shall have factory furnished bonding jumpers.

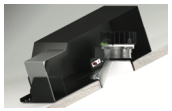
END OF SECTION

Type	Manufacturer	Description	Lamp/Details	Scope/Notes/Location
C1 	Lightnet 1B-X7-O-B-D-8-30-M-D300	12” Diameter surface mounted direct/ indirect general downlight.	15 W per fixture Color Temp: 3000K CRI: 80+ Beam Spread: General Lumens: 1930 per fixture Dim: 0-10V Mount: Surface Finish: Jet Black	Notes: 1, 2 *Location:* *Balcony Stairs* *Ell Stairs*
C2 	Rejuvenation Inc. A6917 - Eastmore 6” Fitter Semi-Flush Fixture	14” Diameter surface mounted decorative fixture.	11 W per fixture (1) 11A19DIM/830 Volts: 120V Color Temp: 3000K CRI: 82 Lumens: 1150 per lamp Dim: ELV Mount: Surface Finish: Oil-Rubbed Bronze	Notes: 1, 2 *Location:* *Lower Lobby*
C3 	Existing	Existing Surface Fixture to be relamped.	7.5 W per fixture (1) LTA19C80030MB Volts: 120V Color Temp: 3000K CRI: 83 Lumens: 800 per lamp Lamp Base: E26 Medium Dim: ELV Mount: Surface	*Location:* *ELL Entry*

Type	Manufacturer	Description	Lamp/Details	Scope/Notes/Location
C4 	Rejuvenation Inc. A6916 - Eastmoreland 4” Fitter Semi-Flush Fixture	12” Diameter decorative surface mount fixture.	11 W per fixture (1) 11A19DIM/830 Volts: 120V Color Temp: 3000K CRI: 82 Lumens: 1150 per lamp Lamp Base: E26 Medium Dim: ELV Mount: Surface Finish: Oil-Rubbed Bronze	Notes: 1, 2 *Location:* *1895 Entry* *Lobby Display*
C5 	Axis Lighting TB2SLED-400-80-30-SO-8-W-XXX-TBD-1	2-1/2” Wide surface mounted linear fixture.	4 W per foot Volts: Per EE Color Temp: 3000K CRI: 80 Lumens: 400 per foot Dim: 0-10V to 1% Mount: Surface Finish: White	Notes: 1, 2 *Location:* *Pantry*
R1 	USAI Lighting B3RDF-09L2-30KS-50-S-WH-WH-NCIC-UNV-D22	3” Recessed exterior downlight.	9 W per fixture Volts: 120~277V Color Temp: 3000K CRI: 80+ Beam Spread: 50° Lumens: 1075 per fixture Dim: 0-10V to 1% Mount: Recessed Finish: Per Architect Rating: Wet Rated	Notes: 1, 2 *Location: Lower Entrance*

Type	Manufacturer	Description	Lamp/Details	Scope/Notes/Location
R2 	JLC Tech TBSL-HW-Varies-24-D-TBD-W Provide with: Appropriately Sized Power Supply	15/16” recessed linear fixture that integrates into ceiling grid.	8 W per foot Volts: 24V Color Temp: 3000K CRI: 82 Lumens: 584 per foot Dim: 0-10V to 1% Mount: T-Bar Finish: White	Notes: 1, 2 *Location:* *Lower Level Acoustical Ceilings*
R3 	USAI Lighting B4RDF-33C3-30KS-50-S-WH-WH-NCIC-UNV-TBD-Mod 1-5/8”	4-1/2” diameter recessed downlight with modified to accommodate a 1-5/8” thick ceiling.	33 W per fixture Volts: 120~277V Color Temp: 3000K CRI: 80+ Beam Spread: 50° Lumens: 2400 delivered per fixture Dim: 0-10V to 0.1% Mount: Recessed Finish: White	Notes: 1, 2 *Location:* *Great Hall*
R4 	USAI Lighting B3RW-20X3-30KS-W2-D1-WH-WH-NCIC-UNV-TBD	3” Diameter recessed lensed wall wash.	20 W per fixture Volts: 120~277V Color Temp: 3000K CRI: 80+ Beam Spread: Wall-Wash Lumens: 1325 per fixture Dim: 0-10V to 0.1% Mount: Recessed Finish: White	Notes: 1, 2, 4, 5 *Location:* *Great Hall*

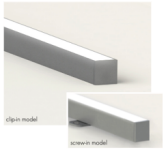
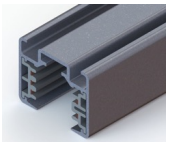
Type	Manufacturer	Description	Lamp/Details	Scope/Notes/Location
R5 	USAI Lighting B4RGF-45-24C3-30KS-40-S-WH-WH-NCIC-UNV-TBD	4-1/5” Diameter downlight for sloped ceilings.	24 W per fixture Volts: 120~277V Color Temp: 3000K CRI: 80+ Beam Spread: 40° Lumens: 40 per fixture Dim: 0-10V to 0.1% Mount: Recessed Finish: White	Notes: 1, 2, 4, 5 *Location:* *Balcony*
R3 - DMX 	USAI Lighting B4RDF-33C3-30KS-50-S-WH-WH-NCIC-UNV-D18-MOD 1-5/8”	4-1/2” diameter recessed downlight with modified to accommodate a 1-5/8” thick ceiling.	33 W per fixture Volts: 120~277V Color Temp: 3000K CRI: 80+ Beam Spread: 50° Lumens: 3450 per fixture Dim: DMX Mount: Recessed Finish: White	Notes: 1, 2, 4, 5, 11 **Stage Light Add Alt** *Location:* *Great Hall*
R4 - DMX 	USAI Lighting B3RW-20X3-30KS-W2-D1-WH-WH-NCIC-UNV-D18	3” Diameter recessed lensed wall wash.	20 W per fixture Volts: 120~277V Color Temp: 3000K CRI: 80+ Beam Spread: Wall-Wash Lumens: 1325 per fixture Dim: 0-10V to 0.1% Mount: Recessed Finish: White	Notes: 1, 2, 4, 5, 11 **Stage Light Add Alt** *Location:* *Great Hall*

Type	Manufacturer	Description	Lamp/Details	Scope/Notes/Location
R5 - DMX 	USAI Lighting B4RGF-45-24C3-30KS-40-S-WH-WH-NCIC-UNV-D28	4-1/5” Diameter downlight for sloped ceilings.	24 W per fixture Volts: 120~277V Color Temp: 3000K CRI: 80+ Beam Spread: 40° Lumens: 40 per fixture Dim: DMX Mount: Recessed Finish: White	Notes: 1, 2, 4, 5, 11 **Stage Light Add Alt** *Location:* *Balcony*
S1 	Lithonia Lighting BLWP4-30L-ADP-GZ1-LP830 Provide with: Aircraft suspension cable where necessary.	4’ Long pendant or surface mounted wraparound linear fixture.	25 W per fixture Volts: 120~277V Color Temp: 3000K CRI: 82 Lumens: 3000 per fixture Dim: 0-10V to 1% Mount: Per Architect Finish: White	Notes: 1, 2, 7 Contractor to provide all necessary parts and pieces to ensure a complete and working system. *Location:* *Utilities* *Attic*
S2 	Axis Lighting TB2DILED-400-400-80-30-SO-SO-Varies-W-UNV-TBD-TBD	2-1/2” Wide by 4” tall direct/ indirect linear pendant.	8 W per foot Volts: 120~277V Color Temp: 3000K CRI: 80 Lumens: 800 per foot Dim: 0-10V to 1% Mount: Pendant Finish: White	Notes: 1, 2, 7 *Location:* *Historical Commission Tables and Chairs*

Type	Manufacturer	Description	Lamp/Details	Scope/Notes/Location
S3 	Existing	Existing exterior pendant to be relamped.	7.5 Watts (1) LTA19C80030MB Volts: 120V Color Temp: 3000K CRI: 83 Lumens: 800 per lamp Lamp Base: E26 Medium Dim: ELV Mount: Pendant	*Location:* *1848 Entry Exterior*
S4 	Ilex 1080-MB-LED	14” Tall decorative pendant.	14 W per fixture (4) LTCA10C35027CB Volts: 120V Color Temp: 2700K CRI: 83 Lumens: 325 per lamp Lamp Base: E12 Candelabra Base Dim: ELV Mount: Pendant Finish: Matte Black	Notes: 1, 2 *Location:* *1848 Entry*
S5 	Rejuvenation Inc. A0013 - Laurelhurst 16” Prismatic Dome & Glass Lens	16” Diameter decorative glass pendant.	15 W per fixture (1) 15A21DIM/830 Volts: 120V Color Temp: 3000K CRI: 80 Lumens: 1650 per lamp Lamp Base: E26 Medium Dim: ELV Mount: Pendant Finish: Oil-Rubbed Bronze	Notes: 1, 2 *Location:* *Great Hall*

Type	Manufacturer	Description	Lamp/Details	Scope/Notes/Location
S6 	Rejuvenation Inc. A6911 - Eastmoreland 6” Fitter Pendant	14” Diameter decorative pendant fixture with 32” long stem.	15 W per fixture (1) 15A21DIM/830 Volts: 120V Color Temp: 3000K CRI: 82 Lumens: 1650 per fixture Lamp Base: E26 Medium Dim: ELV Mount: Pendant Finish: Oil-Rubbed Bronze	Notes: 1, 2 *Location: Balcony*
W1 	Lithonia Lighting OLVTWM	5” Diameter sealed and gasketed wall sconce with cast aluminum housing.	15 W per fixture Volts: 120~277V Color Temp: 4000K CRI: 80 Lumens: 600 per fixture Dim: No Mount: Wall Mount	*Location: Lula*
W2 	Kichler Royal Marine 1 Light 13.25” Wall Light Distressed Black	Exterior wall sconce with LED retrofit lamp.	4.5 W per fixture (1) LTA19C50030MB Volts: 120V Color Temp: 3000K CRI: 83 Lumens: 500 per lamp Lamp Base: E26 Medium Dim: ELV Mount: Wall Mount Finish: Distressed Black	Notes: 1, 2 *Location: Exterior*

Type	Manufacturer	Description	Lamp/Details	Scope/Notes/Location
W3 	Lithonia Lighting BLWP2-20L-APD-EZ1-LP830	2' Long wall mounted wrap-around linear fixture.	17 W per fixture Volts: 120~277V Color Temp: 3000K CRI: 82 Lumens: 1876 per fixture Dim: 0-10V to 1% Mount: Wall Mount Finish: White	Notes: 1, 2 Contractor to provide all necessary parts and pieces to ensure a complete and working system. *Location:* *IT + AV Room* *Janitor Closet*
W4 	Tech Lighting 25-W-C-LED930 - Lynn 25 Bath	25" Long wall mounted vanity fixture.	25 W per fixture Volts: 120V Color Temp: 3000K CRI: 90 Lumens: 1092 per fixture Dim: ELV Mount: Wall Mount Finish: Chrome	Notes: 1, 2 *Location:* *Restrooms*
W5 	Existing	Existing exterior wall sconce. Relamp.	7.5 W per fixture (1) LTA19C80030MB Volts: 120V Color Temp: 3000K CRI: 83 Lumens: 800 per lamp Lamp Base: E26 Medium Dim: ELV Mount: Wall Mount	*Location:* *1848 Entry Exterior*

Type	Manufacturer	Description	Lamp/Details	Scope/Notes/Location
W6 	Luminii BOSW-Varies-30K-HO-G-SC-TBD-TBD Provide with: Remote Driver	1/2” Wide wet rated surface mounted linear LED fixture with grazing optic.	5.2 W per foot Volts: Primary per EE, 24V Secondary Color Temp: 3000K CRI: 91 Beam Spread: 29° Lumens: 116 per foot Dim: 0-10V to 1% Mount: Surface Finish: Per Architect	Notes: 1, 2 **Exterior Add Alt** *Location:* *Exterior Facade*
W7 	B-K Lighting SN-TBD-C-MN-LED-e68-SP-TBD-12 -11-B	1-5/8” Diameter wall mounted exterior adjustable spot fixture.	7 W per fixture Volts: Primary per EE, 12V Secondary Color Temp: 3000K Beam Spread: 17° Lumens: 489 per fixture Dim: MLV Mount: Wall Arm Finish: Per Architect	Notes: 1, 2 **Exterior Add Alt** *Location:* *Exterior Facade*
T1 	Lighting Services Inc. TRK-SC-Varies-120-W - Surface Control Track	2” Wide single-circuit + DMX control surface-mounted extruded aluminum electrified lighting track.	Volts: 120V Dim: DMX + Relay Mount: Surface Finish: White	Notes: 1, 2, 3 **Stage Light Add Alt** Contractor to provide all necessary parts and pieces to ensure a complete and working system. *Location:* *Great Hall*

Type	Manufacturer	Description	Lamp/Details	Scope/Notes/Location
TA 	Lighting Services Inc. LP2-ZE8-22-90-30-12-CT3-DX-120-W Provide with: Louver Hex E Backer Ring E 100% GEL-L20-E (20° Filter) 100% GEL-L40-E (40° Filter) 100% GEL-L60B10-E (60x10° Filter) 100% Fade•Not 2mil Polycarbonate Color Filters (Exact Spec TBD)	8” Diameter DMX controllable track mounted spot fixture.	30 W per fixture Volts: 120V Color Temp: 3000K CRI: 90 Beam Spread: 12º Lumens: 2180 per fixture Dim: DMX Mount: Track Finish: White	Notes: 1, 2, 4, 5, 8, 11 **Stage Light Add Alt** *Location:* *Great Hall*
TC 	Lighting Services Inc. BPM-C06-18-8030-W-CT3-DX-120-W Provide with: 100% E-Size Gobos (Exact Spec TBD) 100% Fade•Not 2mil Polycarbonate Color Filters (Exact Spec TBD)	3” Diameter by 14” long framing projector.	19 W per fixture Volts: 120V Color Temp: 3000K CRI: 80 Beam Spread: 36º-60º Lumens: 1856 per fixture Dim: DMX Mount: Track Finish: White	Notes: 1, 2, 4, 5, 8, 11 **Stage Light Add Alt** *Location:* *Great Hall*
ELV Dimmer - DMX 	Doug Fleenor Design DMX12DIM ELV	12 Channel, ELV DMX512 DImmer to allow for DMX dimming of Great Hall and Balcony pendants.	Volts: 120V Mount: Rack	**Stage Light Add Alt** *Location:* *Lighting Control*
Lighting Control Board 	ETC CS20AV - Colorsource 20 AV	Lighting Control Board		**Stage Light Add Alt** *Location:* *Balcony*
Opto-Splitter 	Pathway Connectivity 1009 - DMX/RDM 4-Way	4-Port DMX Splitter with opto-isolation between ports.		**Stage Light Add Alt** *Location:* *Lighting Control*

General Notes

A Contractor shall supply and install a complete, fully functioning lighting system, including but not limited to: mounting hardware and accessories; appropriately sized transformers; power supplies; drivers; lamps; optical accessories; and electrical appurtenances.

B Contractor shall be responsible for final fixture counts of all lighting fixtures and accessories, as well as linear fixture run lengths, as shown on Architect's drawings.

C Contractor shall be responsible for verifying mounting conditions with mounting locations to ensure compatibility. Contractor shall notify Owner and Architect of any conflicts with all trades prior to the ordering of the equipment. For fixtures where more than one manufacturer is specified, mounting requirements may vary.

D Contractor shall verify compliance of all lighting equipment specified in its intended application on this project with all applicable national and local codes, ordinances, regulations and jurisdictions prior to ordering any equipment.

E Contractor shall supply "Contractor net" unit pricing for each lighting product specified. Unit price shall be for equipment only and shall not include installation or other costs. The unit price supplied shall be guaranteed for the project and valid for additions and deletions of product throughout the duration of the project.

F All drawings represent visual concepts and suggestions only. Available Light is not qualified to determine structural or electrical suitability and will not assume liability for improper engineering, construction or handling of design concepts.

G The accompanying drawings and all the ideas, arrangements, designs, and plans indicated thereon or represented thereby are owned by and remain the property of Available Light and have been created and developed for use on and in connection with the specified project. Neither this drawing, nor any such ideas, arrangements, designs, or plans shall be appropriated by or disclosed to any person, firm, or corporation for any use or purpose whatsoever, except by the specific and written permission of Available Light.

H Written dimensions on drawings shall have authority over scaled measurements. Contractor shall field verify all dimensions on the job and inform the Architect of any proposed variations from drawings prior to performing the work.

I Do not scale electrical drawings for exact location of the lighting fixtures. Refer to Architect reflected ceiling plans and other lighting layouts for proper locations of lighting fixtures.

J Contractor shall not substitute products unless approved in writing by Available Light and/or Architect. Lighting fixture, ballast, driver, power supply, lamp, and/or accessory substitutions shall be formally presented to Available Light no later than fourteen (14) working days prior to bid due date.

All proposed substitute fixtures must:

1) Be proven to meet or exceed the standards of quality, design, appearance, and performance as established by the lighting fixture specified by Available Light. See next note for list of items to be submitted for all substitutions.

2) Afford to the owner a significant economic benefit.

Contractor shall coordinate changes due to use of approved substitutes with all trades.

K

For a fixture type where a manufacturer is named as equal, the equal shall meet aesthetic criteria of the specified fixture, including but not limited to: dimensional criteria, finishes, including custom finishes; mounting details; and specified modifications.

Additionally, for a fixture type where a manufacturer is named as equal, the equal shall meet the minimum performance requirements as defined by specified product, including but not limited to: regulatory listings; output as measured in delivered lumens; center beam candle power (CBCP); baseline efficacies as measured in lumens delivered per watt; cut-off angle as measured from nadir; LED binning; color rendering (CRI); color temperature (CCT); Duv per Manufacturers supporting documentation; dimming and method; five (5) year minimum warranty including LED engine and driver; L70 lumen maintenance tested according to IES LM79; and specified modifications.

L

Contractor shall provide the following items to the Architect and Available Light for evaluation of proposed substitutions:

1) A current manufacturer's data sheet with luminaire catalog numbers.

2) A complete and working sample wired with cord and plug for 120V operation furnished upon request.

3) A complete photometric report for the proposed substitute fixture using the same lamp type, wattage, and distribution as per the specification. The photometric report should include TM-30 or CRI documentation with R 1-14 values, tabulated candlepower values, a coefficient of utilization table, and an ISO foot-candle diagram from an independent testing laboratory. The photometric report must reflect the fixture specified without modification to the file.

4) The specified product defines minimum performance requirements as defined by specified product including but not limited to: regulatory listings; output as measured in delivered lumens; center beam candle power (CBCP); baseline efficacies as measured in lumens delivered per watt; cut-off angle as measured from nadir; LED binning; color rendering (CRI); color temperature (CCT); Duv per Manufacturers supporting documentation; dimming and method; five (5) year minimum warranty including LED engine and driver; and L70 lumen maintenance tested according to IES LM79.

5) The Contractor shall submit a signed document stating that if the proposed substitution is accepted the project schedule will not be negatively affected.

M

Contractor shall provide the following items to the Architect and Available Light for evaluation of specified fixtures:

1) Manufacturer’s product data sheets for each luminaire indicating luminaire type, dimensions, driver/ballast/power supply/transformer quantity and type, lamp quantity and type, photometric data (including lumnen output, CRI & TM-30 data), materials, finishes, accessories, voltage, input wattage, CFM data, and photographic image of luminaire.

2) Manufacturer’s data sheet for each driver/ballast/power supply/transformer including driver/ballast/power supply/transformer type, power factor, input voltage, input watts, and ballast factor.

3) Scaled and dimensioned detail plan and elevation drawings of custom and continuous row type luminaires including joints, mounting points and type, power connection locations(s), and emergency or separate switching configurations.

4) For custom luminaires, manufacturer shall perform and submit all engineering calculations as required to ensure the safe and proper installation and operation of the luminaire.

5) Dimming Power Supply Compatibility Certificates: Signed by driver/ballast/power supply manufacturer certifying that driver/ballast/power supply is compatible with dimming systems and equipment with which they are used.

6) For all submittals contractor shall submit within 2 weeks of award of bid. All submittals shall have project name and luminaire type clearly shown.

N	Electronic devices that generate radio frequency energy must not interfere with other electronic devices and must not be susceptible to interference from other devices. Equipment shall not be an Electromagnetic (EM) polluter or be effected by EM pollution. All relevant equipment shall comply with current EMC standards.
O	Unless otherwise specified all downlights (recessed, wallwasher, and adjustable) shall be supplied by the same manufacturer, and all linear fixtures (recessed, pendant, and surface mounted) shall be supplied by the same manufacturer.
P	Unless otherwise specified, all retrofit LED lamps shall be manufactured by LEDvance (Osram-Sylvania), Philips, GE, Soraa, or Green Creative. All lamps of a given type shall be supplied by the same manufacturer.
Q	Unless otherwise specified, all LED drivers shall be manufactured by one of the following: Advance (Philips), LEDvance (Osram Sylavnia), Hatch, EldoLED, or Lutron.
R	All fixtures shall be supplied with specified lamp(s). Contractor shall provide an additional 10% replacement lamps (minimum two of each lamp type specified). For fixtures that use replaceable LED modules and drivers rather than lamps, Contractor shall provide an additional 5% (minimum one) of each driver and module type.
S	Fixture construction and installation shall ensure no light leaks between ceiling trims of recessed lighting equipment and the ceiling plane. For applications in perforated or partially transparent ceilings, fixture construction shall also ensure no light leaks above the ceiling line.
T	Reflectors, reflector cones, and visible trim of all lighting fixtures shall not be installed until completion of plastering, ceiling tile work, painting, and general cleanup. Reflectors, reflector cones, and visible trim shall be carefully handled to avoid scratching or fingerprinting.
U	At the time of acceptance by the Owner, all lighting fixtures shall have been thoroughly cleaned with materials and methods recommended by the manufacturers, all broken parts shall have been replaced, and all lamps and/or LED modules shall be operative.
V	The Owner shall perform regular maintenance on all luminaires in order to ensure expected performance. Fixtures may produce light past their rated life, however, lamps/ballasts/drivers/components must be replaced at or before rated end-of-life for the luminaire to meet minimum photometric performance standards. Neither the Architect nor Available Light shall be held responsible or liable for improper service and maintenance of lighting systems.
W	Budget pricing is the cost the Owner should be prepared to pay for a specific luminaire or system. Price includes lamp(s) but does not include freight, tax, or installation costs. Owner level fixture prices were received directly from the manufacturer's agent, or derived by adding a 15% distributor markup and a 15% contractor markup to a Distributor Net price received from the manufacturer's agent, unless otherwise noted. Details regarding the source of individual fixture budget prices are available upon request.
X	Contractor shall supply all low-voltage control data lines and wiring in order to properly network and dim fixtures together per control intent documentation and manufacturer’s documentation. Data runs must be properly terminated.

Project Specific Notes

1	Final finish of fixture shall be approved in writing by Architect.
2	Mounting height shall be coordinated with Architect's elevations.
3	The Base Building Contractor shall install one track fixture per track run per circuit, for the purpose of confirming that all tracks are energized and operational.

4	Fixture shall be aimed and focused by Contractor under the direction of Available Light.
5	The Contractor shall provide all ladders and mechanical lifts (i.e scissors lifts, articulating boom arm lifts, etc.) for the exclusive use of the aim and focus effort. The number and type of lifts and/or ladders to be pre-approved by Available Light. Crew shall arrive at aim and focus equipped with appropriate aim and focus tools including wrenches, gloves, electrical testers, etc., as per industry standards for a theatrical lighting technician. All costs associated with aiming and focusing shall be included in the bid, including but not limited to travel expenses, parking, storage, etc.
6	Junction boxes and/or conduit that is used to wire fixtures and that is open to view shall be painted to match adjacent structure.
7	Fixture or track shall be mounted to structure in a manner recommended by the manufacturer without compromising the integrity of the structure. Contractor shall be responsible for all materials required to insure a safe and proper pendant installation. Contractor to coordinate changes in size of fixtures or track due to use of approved substitutes with all trades. Tracks shall be mounted to prevent twisting when fixtures are aimed and focused causing an asymmetrical load.
8	Prior to the onsite arrival of Available Light, all luminaires shall be installed in the proper positions as indicated in the construction documents with all mechanical shutters pulled and beams of light directed straight down. Accessories (spread lenses, color filters, screens, gobos, top hats, snoots, etc.) shall be installed under the supervision of Available Light during the aim and focus period.
9	Remote transformers, power supplies, or drivers shall be located in nearby accessible, concealed-from-view location with manufacturer recommended ventilation available. As per manufacturer's recommendations, Contractor shall not exceed the maximum allowable distance between any luminaire and its associated remote control devices. Contractor shall supply manufacturer's transformer, power supply or driver of proper capacity.
10	“Local Control” means the controller or dimmer is mounted within the exhibit, rather than a central lighting controller.
11	Prior to aim and focus, all DMX fixtures shall be properly addressed per Available Light's specification and tested using the specified control system (i.e. not a local test device).
12	Fixture shall be furnished and installed by Exhibit Fabricator. Exhibit Fabricator shall be responsible for final electrical termination.
13	Fixture shall be furnished and installed by Base Building Contractor. Base Building Contractor shall be responsible for final electrical termination.
14	Fixture shall be furnished by Exhibit Fabricator and installed by Base Building Contractor. Base Building Contractor shall be responsible for final electrical termination.
15	Due to rapid advances in LED technology, Available Light reserves the right to change lamp or LED module specifications at the time of submittal to another lamp or LED module of equal or lesser cost.

AVAILABLE LIGHT

Stow Town Hall

Lighting Fixture Cut Sheets

Construction Document

30 Sep 2021

Mills Whitaker Architects

Available Light • 919.364.6464 x127
5700 Six Forks Road, Suite 203 • Raleigh NC 27609

Mills Whitaker Architects

Stow Town Hall

Construction Document

Type

C1

Cut sheet 1 of 2

Wall or ceiling mounted LED light, with a 18 mm tall, visible tiered frame housing. Direct-indirect or direct only light distribution. Opal diffuser made of satin acrylic glass for general lighting. Minimalist design with perfectly uniform lighting. Indirect component with innovative lens technology for wide-beam ceiling illumination. Luminaire body made of aluminum profile optionally available in white, silver, graphite, black, titanium or copper colors. Converter integrated in luminaire housing, switched or dimmed 1-10V. Standard color temperature 2200K, 2700K, 3000K, 3500K, 4000K or 6500K. Binning initial ≤ MacAdam 3. Color rendering CRI> 80, alternative CRI> 90.

IP20 ⏚ ~120V

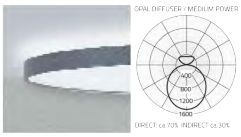
D [mm]	D [Inch]
300	11 13/16"
400	1'-3 3/4"
500	1'-7 11/16"
600	1'-11 5/8"

PRODUCT-CODE: 1B X7 O S D - 8 30 M - D300

PRODUCT FAMILY	**1B**: Basic
TYPE	**X7**: Direct-Indirect, **Y7**: Direct-Only
OPTICAL SYSTEM	**O**: Opal
SURFACE FINISH	**W**: Snow White, **V**: Ivory White, **S**: Radiant Silver, **U**: Urban Graphite, **B**: Jet Black, **T**: Satin Titanium, **K**: Satin Copper
CONTROL GEAR	**D**: 1-10V
Color REND.	**8**: CRI>80, **9**: CRI>90
Color TEMP.	**22**: 2200K, **27**: 2700K, **30**: 3000K, **35**: 3500K, **40**: 4000K, **65**: 6500K
POWER	**M**: Medium Power, **H**: High Power
SIZE	Luminaire Diameter in mm: **D300**, **D400**, **D500**, **D600**

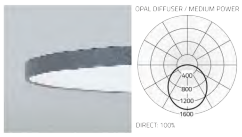
11

OPAL DIFFUSER / DIRECT-INDIRECT



D [inch]	Lumen/Watt Medium Power
11 13/16"	1930lm/15W
1'-3 3/4"	2710lm/21W
1'-7 11/16"	3960lm/29W
1'-11 5/8"	5860lm/41W

OPAL DIFFUSER / DIRECT



D [inch]	Lumen/Watt Medium Power
11 13/16"	1490lm/12W
1'-3 3/4"	1990lm/15W
1'-7 11/16"	2830lm/21W
1'-11 5/8"	4210lm/27W

Lumen Values: Luminaire luminous flux at 4000K/CRI>80. Other configurations on request.


SNOW WHITE


RADIANT SILVER


URBAN GRAPHITE


JET BLACK


SATIN TITANIUM


SATIN COPPER

Mills Whitaker Architects

Stow Town Hall

Construction Document

Type

C1

Cut sheet 2 of 2

REJUVENATION

Eastmoreland 6" Fitter Semi-Flush Fixture

Item #A6917

http://www.rejuvenation.com/s/1bou9

Specification	Detail
Item #	A6917
Finish	Oil-Rubbed Bronze
Socket type	E26
Shade	B0262-14 in-OP
Shade SKU	B0262-14 in-OP
Max Wattage	60 W
UL Listed	UL Listed
UL Location	Damp
Canopy	6-1/2"
Overall Width	14"
Length	10-1/8"
Shade height	6"

Mills Whitaker Architects

Stow Town Hall

Construction Document

Type

C2

Cut sheet 1 of 4

Project Name:	Type:
Part Number:	Date:

GREENCREATIVE

Value Select A Lamp Family

FEATURES

- Suitable to replace 40W, 60W, 75W, 100W Incandescent
- Comfortable diffused light
- Smooth dimming with existing dimmers*
- Suitable for use in damp locations
- Operating temperature: -4°F / -20°C to +95°F / +35°C
- Rated Lifetime (L70): 25,000hrs
- 3 year limited warranty

c UL us LISTED

ENERGY STAR

SPECIFICATIONS

Product	Model	Equiv.	Wattage (W)	CCT	Lumens	Efficacy (LPW)	Input Voltage	Beam Angle	CRI	Dim.*	Power Factor	Base	Fixture Rating	Lifetime (L70) (hrs)	Cert.
97985	6A19DIM/827/R	40W	6	2700K	480	80	120V	220°	82	Yes	0.9	E26	Non-Enclosed	25,000	ES
97986	6A19DIM/830/R	40W	6	3000K	480	80	120V	220°	82	Yes	0.9	E26	Non-Enclosed	25,000	ES
98011	8A19DIM/827/R	60W	8	2700K	800	100	120V	220°	82	Yes	0.9	E26	Non-Enclosed	25,000	ES
98012	8A19DIM/830/R	60W	8	3000K	800	100	120V	220°	82	Yes	0.9	E26	Non-Enclosed	25,000	ES
98013	8A19DIM/840/R	60W	8	4000K	800	100	120V	220°	82	Yes	0.9	E26	Non-Enclosed	25,000	ES
97908	9A19DIM/827/GU24/R	60W	9	2700K	800	89	120V	240°	82	Yes	0.9	GU24	Enclosed	25,000	ES
97909	9A19DIM/830/GU24/R	60W	9	3000K	820	91	120V	240°	82	Yes	0.9	GU24	Enclosed	25,000	ES
97910	9A19DIM/840/GU24/R	60W	9	4000K	860	96	120V	240°	82	Yes	0.9	GU24	Enclosed	25,000	ES
98138	11A19DIM/827	75W	11	2700K	1100	100	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98139	11A19DIM/830	75W	11	3000K	1150	105	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98140	11A19DIM/840	75W	11	4000K	1200	109	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98144	15A21DIM/827	100W	15	2700K	1600	107	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98145	15A21DIM/830	100W	15	3000K	1650	110	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98146	15A21DIM/840	100W	15	4000K	1700	113	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98150	15A21DIM/827/GU24	100W	15	2700K	1600	107	120V	240°	82	Yes	0.9	GU24	Enclosed	25,000	ES
98083	14A19/827/3WAY	40W 60W 100W	4 8 14	2700K	500 1000 1500	125 125 107	120V	230°	82	No	0.9	E26d	Non-Enclosed	15,000	ES

* This lamp might not be compatible with all dimmers. Please visit www.greencreative.com for compatibility information.

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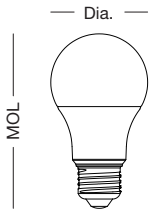
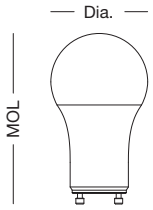
Cut sheet 2 of 4

Value Select A Lamp Family

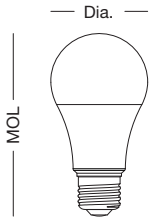
DIMENSIONS & WEIGHT



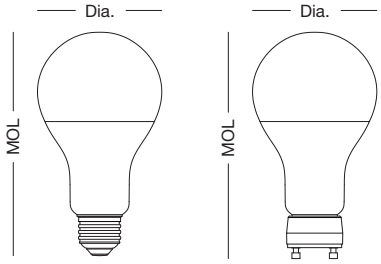
Model	Base	MOL	Dia.	Weight
6A19DIM/xxx/R	E26	4-3/16”	2-3/8”	0.07lb
8A19DIM/xxx/R	E26	4-3/16”	2-3/8”	0.08lb



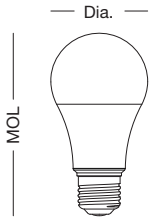
Model	Base	MOL	Dia.	Weight
9A19DIM/xxx/GU24/R	GU24	4-3/16”	2-3/8”	0.11lb



Model	Base	MOL	Dia.	Weight
11A19DIM/xxx	E26	4-7/16”	2-3/8”	0.13lb



Model	Base	MOL	Dia.	Weight
15A21DIM/xxx	E26	5-7/16”	3”	0.23lb
15A21/xxx/GU24	GU24	5-1/2”	3”	0.26lb



Model	Base	MOL	Dia.	Weight
14A19/xxx/3WAY	E26d	4-5/8”	2-3/8”	0.25lb

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Cut sheet 3 of 4

GREENCREATIVE

Value Select A Lamp Family

MINIMUM COMPARTMENT DIMENSIONS		
Model	Diameter	Height
6A19DIM/xxx/R	6”	8-1/2”
8A19DIM/xxx/R	6”	8-1/2”
9A19DIM/xxx/GU24/R	6”	8-1/2”
11A19DIM/xxx	6”	8-1/2”
15A21DIM/xxx	6”	8-1/2”
15A21/xxx/GU24	6”	8-1/2”
14A19/xxx/3WAY	6”	8-1/2”

Installing lamp in a fixture that does not have the minimum compartment dimensions will void the warranty and could cause product failures.

080819

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C3

Cut sheet 1 of 2

ARCHIPELAGO LIGHTING
Lighting | Reinvented

NOSTALGIC

A19

COMMERCIAL GRADE

FILAMENT LED

60 Watt

REPLACEMENT

USES ONLY 7.5W

- NATURAL DIMMING – DIM TO OFF[2]
- SUITABLE FOR WET LOCATIONS
- ENCLOSED RATED
- 25,000 HOURS RATED LIFE
- 3-YEAR LIMITED WARRANTY
- 360° LIGHT DISTRIBUTION
- ENERGY STAR LISTED[3]
- UL LISTED

ALSO AVAILABLE IN:

SILVER-TIP

FROSTED

Ordering Information (A19, 60W)

Model Number	Type	Base	Lumens	Wattage	MOL I MOD	CCT	CRI
LTA19C80024MB	Glass I Clear	E26 I Medium	800LM	7.5W	4.1" I 2.4"	2400K	83
LTA19C80027MB	Glass I Clear	E26 I Medium	800LM	7.5W	4.1" I 2.4"	2700K	83
LTA19C80030MB	Glass I Clear	E26 I Medium	800LM	7.5W	4.1" I 2.4"	3000K	83
LTA19C80041MB	Glass I Clear	E26 I Medium	800LM	7.5W	4.1" I 2.4"	4100K	83
LTA19F80024MB	Glass I Frosted	E26 I Medium	800LM	7.5W	4.1" I 2.4"	2400K	83
LTA19F80027MB	Glass I Frosted	E26 I Medium	800LM	7.5W	4.1" I 2.4"	2700K	83
LTA19F80030MB	Glass I Frosted	E26 I Medium	800LM	7.5W	4.1" I 2.4"	3000K	83
LTA19F80041MB	Glass I Frosted	E26 I Medium	800LM	7.5W	4.1" I 2.4"	4100K	83
LTA19S80024MB	Glass I Silver	E26 I Medium	800LM	7.5W	4.1" I 2.4"	2400K	83
LTA19S80027MB	Glass I Silver	E26 I Medium	800LM	7.5W	4.1" I 2.4"	2700K	83

NOTE 1: Alternative CCTs are available as special order. Please contact sales@archipelagolighting.com for more information.
NOTE 2: Please reference dimmer compatibility list at www.archipelagolighting.com
NOTE 3: Please look for the Energy Star logo for listed products.

RoHS Pb ENERGY STAR PARTNER

ARCHIPELAGO LIGHTING, INC. I 4615 State Street, Montclair CA, 91763 I t: (866) 912-3220 I f: (909 627-2887

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C3

Cut sheet 2 of 2

REJUVENATION

Eastmoreland 4" Fitter Semi-Flush Fixture

Item #A6916

http://www.rejuvenation.com/s/1bord

Specification	Detail
Item #	A6916
Finish	Oil-Rubbed Bronze
Shade	B0259-12 in-OP
Shade SKU	B0259-12 in-OP
Max Wattage	60 W
UL Listed	UL Listed
UL Location	Damp
Canopy	4-7/8"
Overall Width	12"
Length	9-1/2"
Shade height	6"

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Construction Document

Type

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Cut sheet 1 of 4

Project Name:	Type:
Part Number:	Date:

GREENCREATIVE

Value Select A Lamp Family

FEATURES

- Suitable to replace 40W, 60W, 75W, 100W Incandescent
- Comfortable diffused light
- Smooth dimming with existing dimmers*
- Suitable for use in damp locations
- Operating temperature: -4°F / -20°C to +95°F / +35°C
- Rated Lifetime (L70): 25,000hrs
- 3 year limited warranty

c UL us LISTED

SPECIFICATIONS

Product	Model	Equiv.	Wattage (W)	CCT	Lumens	Efficacy (LPW)	Input Voltage	Beam Angle	CRI	Dim.*	Power Factor	Base	Fixture Rating	Lifetime (L70) (hrs)	Cert.
97985	6A19DIM/827/R	40W	6	2700K	480	80	120V	220°	82	Yes	0.9	E26	Non-Enclosed	25,000	ES
97986	6A19DIM/830/R	40W	6	3000K	480	80	120V	220°	82	Yes	0.9	E26	Non-Enclosed	25,000	ES
98011	8A19DIM/827/R	60W	8	2700K	800	100	120V	220°	82	Yes	0.9	E26	Non-Enclosed	25,000	ES
98012	8A19DIM/830/R	60W	8	3000K	800	100	120V	220°	82	Yes	0.9	E26	Non-Enclosed	25,000	ES
98013	8A19DIM/840/R	60W	8	4000K	800	100	120V	220°	82	Yes	0.9	E26	Non-Enclosed	25,000	ES
97908	9A19DIM/827/GU24/R	60W	9	2700K	800	89	120V	240°	82	Yes	0.9	GU24	Enclosed	25,000	ES
97909	9A19DIM/830/GU24/R	60W	9	3000K	820	91	120V	240°	82	Yes	0.9	GU24	Enclosed	25,000	ES
97910	9A19DIM/840/GU24/R	60W	9	4000K	860	96	120V	240°	82	Yes	0.9	GU24	Enclosed	25,000	ES
98138	11A19DIM/827	75W	11	2700K	1100	100	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98139	11A19DIM/830	75W	11	3000K	1150	105	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98140	11A19DIM/840	75W	11	4000K	1200	109	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98144	15A21DIM/827	100W	15	2700K	1600	107	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98145	15A21DIM/830	100W	15	3000K	1650	110	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98146	15A21DIM/840	100W	15	4000K	1700	113	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98150	15A21DIM/827/GU24	100W	15	2700K	1600	107	120V	240°	82	Yes	0.9	GU24	Enclosed	25,000	ES
98083	14A19/827/3WAY	40W 60W 100W	4 8 14	2700K	500 1000 1500	125 125 107	120V	230°	82	No	0.9	E26d	Non-Enclosed	15,000	ES

* This lamp might not be compatible with all dimmers. Please visit www.greencreative.com for compatibility information.

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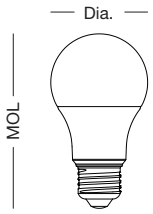
Type

C4

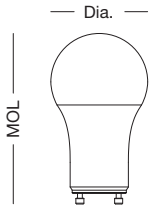
Cut sheet 2 of 4

Value Select A Lamp Family

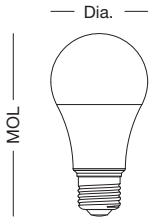
DIMENSIONS & WEIGHT



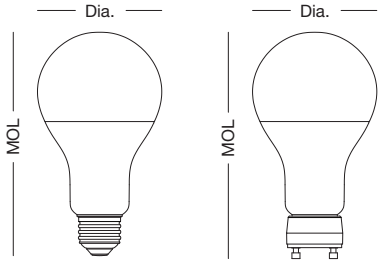
Model	Base	MOL	Dia.	Weight
6A19DIM/xxx/R	E26	4-3/16”	2-3/8”	0.07lb
8A19DIM/xxx/R	E26	4-3/16”	2-3/8”	0.08lb



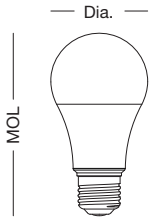
Model	Base	MOL	Dia.	Weight
9A19DIM/xxx/GU24/R	GU24	4-3/16”	2-3/8”	0.11lb



Model	Base	MOL	Dia.	Weight
11A19DIM/xxx	E26	4-7/16”	2-3/8”	0.13lb



Model	Base	MOL	Dia.	Weight
15A21DIM/xxx	E26	5-7/16”	3”	0.23lb
15A21/xxx/GU24	GU24	5-1/2”	3”	0.26lb



Model	Base	MOL	Dia.	Weight
14A19/xxx/3WAY	E26d	4-5/8”	2-3/8”	0.25lb

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GREENCREATIVE

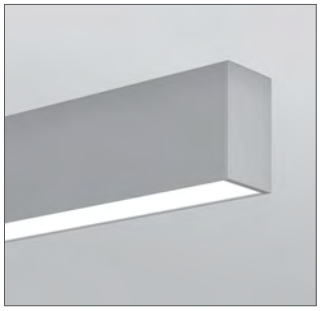
Value Select A Lamp Family

MINIMUM COMPARTMENT DIMENSIONS		
Model	Diameter	Height
6A19DIM/xxx/R	6”	8-1/2”
8A19DIM/xxx/R	6”	8-1/2”
9A19DIM/xxx/GU24/R	6”	8-1/2”
11A19DIM/xxx	6”	8-1/2”
15A21DIM/xxx	6”	8-1/2”
15A21/xxx/GU24	6”	8-1/2”
14A19/xxx/3WAY	6”	8-1/2”

Installing lamp in a fixture that does not have the minimum compartment dimensions will void the warranty and could cause product failures.

080819

Beam 2 | Surface mount


Flush Spotless Lens


Louver


Glo Lens

Project _____

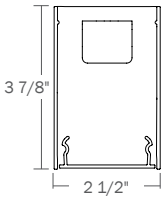
Type _____

Notes _____

PERFORMANCE PER LINEAR FOOT AT 3500K

NOMINAL LUMEN OUTPUT	INPUT WATTS*	EFFICACY	SHIELDING
1000 lm/ft	9.9 W/ft	97 lm/W	L

Please consult factory for custom lumen output and wattage.



Spotless Lens | Louver | Glo lens 0.25"

CONTROL SENSORS

Ordering Guide

TB2SLED									
PRODUCT ID		**NOM. LUM/FT DOWN**		**CRI**		**COLOR TEMP.**		**SHIELDING**	
TB2SLED	BEAM2 - Surface LED	**400**	400 lm/ft - Minimum	**80**	80 CRI	**27**	2700 K	**SO**	spotless lens
		1000	1000 lm/ft - Maximum*	**90**	90 CRI	**30**	3000 K	**L**	louver*
						35	3500 K	**0.25G**	0.25" Glo lens
						40	4000 K		
		Outputs between listed min and max are available. Consult factory for outputs outside of the listed range. * 1000 lm only for louver.				Consult Axitune spec sheet for Axis color technology options		Choose only one of the options above; SurroundLite not available with direct * Available in 3' and 4' combinations; otherwise consult factory.	

LENGTH (FT)		MR (OPTIONAL)		FINISH		VOLTAGE		DRIVER		CIRCUITS	
2	2'	**DMLED(#)**	downlight modle LED	**AP**	aluminum paint	**120**	120 V	**DP**	dimming (0-10V) 1%	**1**	1 circuit
3	3'			**W**	white	**277**	277 V	**LT**	Lutron (1)	**2**	2 circuits
4	4'			**BLK**	black	**347**	347 V	**BI**	bi-level dimming	**+E(#)**	emergency circuit (3)
5	5'			**C**	custom	**UNV**	universal	**O**	other (2)	**+NL(#)**	night light circuit (3)
8	8'									**+GTD(#)**	generator transfer device (3)
12	12'									**+M**	MR
S#	System Run										
		Add 6" per lamp, Specify quantity Separate circuits included						(1) Specify system (2) Please consult factory; see page 2 Consult Axitune spec sheet for Axis color driver options		(3) Specify quantity	

MOUNTING/SUSPENSION		BATTERY (OPTIONAL)		OTHER (OPTIONAL)		IC CONTROLS (OPTIONAL)		CUSTOM (OPTIONAL)	
SB9	surface TB/TG 9/16	**B#**	battery pack (integral)	**F**	fuse (4)	**DS#**	daylight sensor	**C**	custom
SB15	surface TB/TG 15/16					**OS#**	occupancy sensor		
SBS	surface screw slot t-bar					**DOS#**	daylight & occupancy sensor		
S	surface drywall ceiling					**EN#**	Enlighted integral (5)		
SC	surface solid ceiling					**ENR#**	Enlighted remote (5)		
						WC#	wireless control dimming		
		Minimum 5ft; Not available with 347V Please consult factory		(4) Requires 120V or 277V		(5) Please consult factory Specify quantity. Requires 8" blank. See integrated controls guide for more details.		Please specify	

1.800.263.2947
[T] 514.948.6272
axislighting.com

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CONSTRUCTION

Housing	Extruded aluminum (0.075'' nominal) Up to 70% recycled content
End Cap	Cast aluminum
Interior Brackets	Die formed sheet steel (20 gauge)
Reflectors	White powder coated sheet steel (22 gauge)
Louvers	Die formed semi-specular aluminum (22 gauge)
Lenses	Extruded acrylic (0.070'' nominal)
Hanger	Die cast aluminum

ELECTRICAL

Lutron driver*	LDE1 - EcoSystem H-Series (1%) LDE5 - EcoSystem 5-Series (5%) LTE - Hi-Lume® A-series 2Wires Forward Phase (1%) *Consult factory
Other drivers	DALI - Digital Addressable Lighting Interface DMX - Digital Multiplex LV - line voltage - Advance Mark 10 Xitanium SR - For wireless sensor POE (Power over Ethernet) - Low Voltage Lighting System.
Emergency	Integral emergency battery pack or emergency circuit optional.
Input Voltage	120V, 277V, 347V, UNV.

Incorporating these components may have limitations or affect the length of the luminaire. Please contact factory for more details.

LED SYSTEM

CRI	Minimum 80 or 90 color rendering index.
CCT	Choice of 2700K, 3000K, 3500K and 4000K color temperature with a great color consistency (within 3–step MacAdam ellipse). Both within fixture and fixture to fixture.
LED life	Minimum 50,000h with 85% of lumen maintenance in 25°C ambient temperature, in compliance with IES LM-80 testing measurements.
Thermal Management	Aluminum housing acting as the heat sink to maximize life.
Environment	Dry and damp rated in operating ambient temperatures of 0-40°C (32-104F).
Louver LED	Individual LED cluster in each louver cell

FINISH

Aluminium paint, powder coated and custom finishes are also available.

APPROVALS

Certified to UL and CSA standards
Meets NYC requirements
Meets ADA requirements.
Suitable for damp locations.

OPTICS


SO Spotless lens


L Louver


0.25G Glo lens

SPOTLESS LENS
Frosted acrylic snap-in micro lens

PARABOLIC LOUVERS
Die formed semi-specular aluminum (22 gauge)

GLO LENS
0.25″ frosted acrylic drop lens. Patented design.

SYSTEM (S#)

BEAM 2 SurroundLite linear systems, with the use of a strong profile, allow for a nearly hair thin connection system of continuous runs. Lengths of 4', 8', 12' as well as custom lengths are available. Runs of BEAM 2 SurroundLite that are greater than 12' in length are designated as systems (S#). This means that the run is comprised of a combination of 4', 8' and/or 12' sections to be assembled on site using our joining system. For more information on systems and joining, please refer to the BEAM installation sheets available for download at www.axislighting.com.

WARRANTY

Axis Lighting will warrant defective LEDs, boards, and drivers for 5 years from date of purchase. Warranty is valid if luminaire is installed and used according to specifications. If defective, Axis will send replacement boards or drivers at no cost along with detailed replacement instructions and instructions on how to return defective components to Axis.

1.800.263.2947
[T] 514.948.6272
axislighting.com

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Type

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Cut sheet 2 of 5

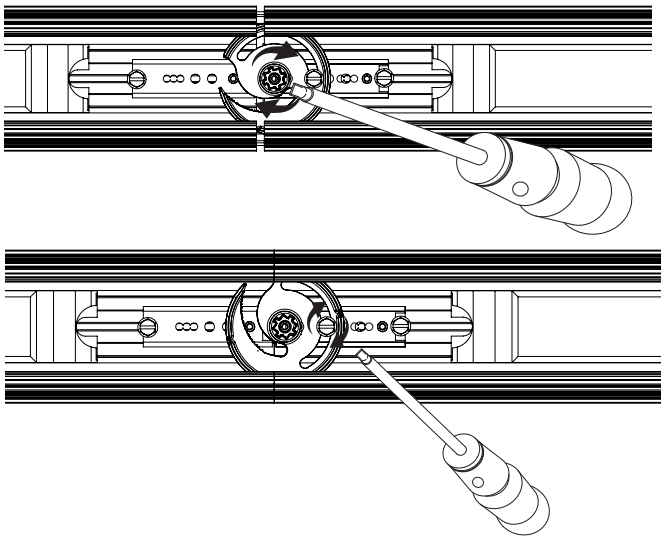
InstaJoiner

BEAM2 SurroundLite luminaires feature InstaJoiner, a unique, patent-pending joining system developed by Axis offering fast, single-screw tightening.

NOTE: Mount each system segment individually.

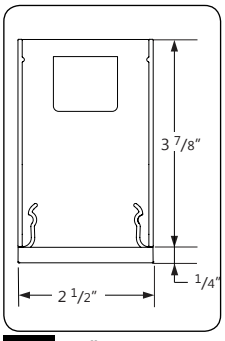
Do not assemble system prior to mounting

Allow a minimum of 6" between end of long runs and wall.

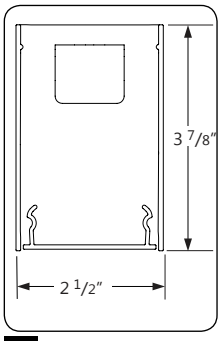


Patent - Pending

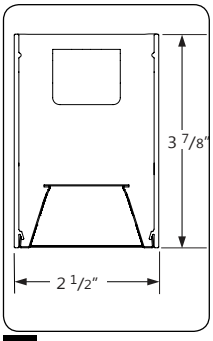
SECTION VIEWS



0.25G **0.25" Glo lens - Direct**



SO **Spotless lens - Direct**



L **Louver - Direct**

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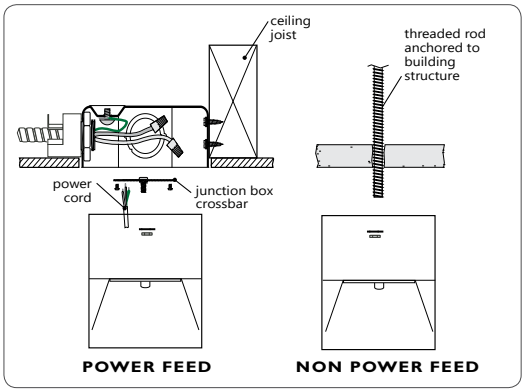
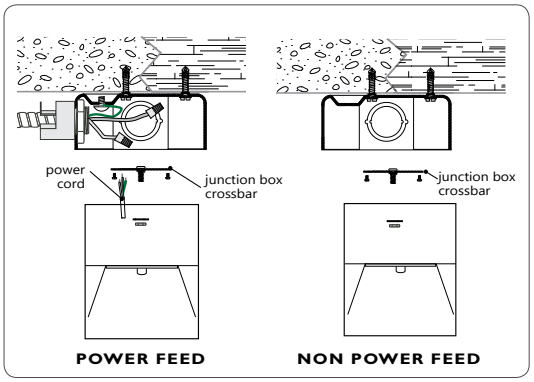
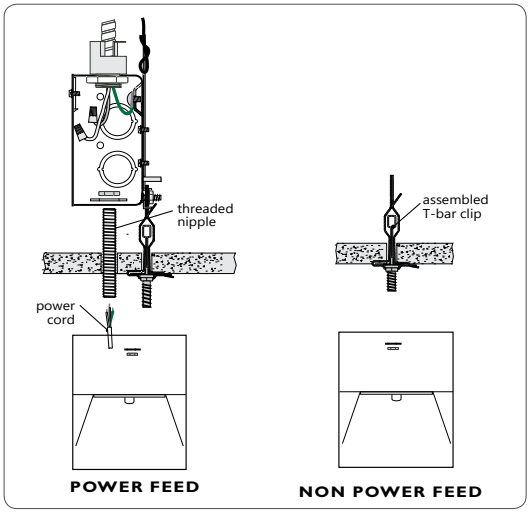
MOUNTING DETAILS



S SURFACE MOUNT DRYWALL CEILING



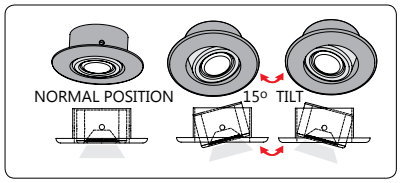
SC SURFACE MOUNT SOLID CEILING



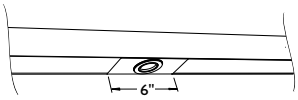
SB9 **SB15** **SBS** SURFACE MOUNT T-BAR CEILING

DMLED MODULE

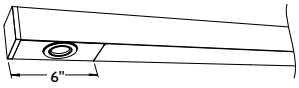
Blank LED Module	Extruded aluminum (0.075'' nominal) 2'' diameter
Quantity	For every 4' section, there may be up to a maximum of 4 x DMLED module.
Spacing	Each DMLED module is placed centered on a blank section 6'' in length. For a series of modules within a given section length, they will be spaced evenly on a longer blank section. Custom spacing may be available on special request.
Tilt	15° each side.



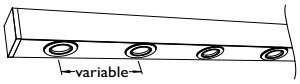
Between sections



At luminaire ends



Several in a long blank section



Beam Angle	30 nominal degrees
Input Watts	3W
Nominal Lumens	126 lumens
Efficacy	42 lumens per watt
Color Rendering Index (CRI)	80
Life	25,000 hours at L_{70}
Correlated color temperature (CCT)	3000K

More options are available upon request. Please consult factory.

* See photometric report.

OTHER MOUNTING OPTIONS

BEAM 2 SurroundLite is also available with wall mounted option.

Specification sheets and installation sheets for all mountings for BEAM 2 SurroundLite luminaires are available for download at www.axislighting.com

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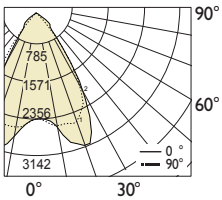
● *PHOTOMETRIC DATA*

Uplight
0 lm/ft
Downlight
1000 lm/ft

PHOTOMETRIC CURVE



Lumen/ft up: 0 lm/ft
Lumen/ft down: 1000 lm/ft
Total Lumens: 3645 lm (for 4ft)
Input Watts: 39.6 W
Efficacy: 92 lm/W
IES FILE: TB2DILED-0-1000-80-35-L-4.IES

TESTED ACCORDING TO IES LM-79-2008

CANDELA DISTRIBUTION

	Horizontal Angles				
Vertical Angle	0	22.5	45	67.5	90
0	2297	2297	2297	2297	2297
5	2356	2348	2337	2321	2312
15	2483	2504	2693	2915	2904
25	2322	2513	3107	3055	2851
35	1290	1752	2342	1633	1320
45	194	307	658	478	428
55	32	48	76	175	250
65	6	8	13	17	20
75	2	2	3	5	5
85	0	1	1	1	1
90	0	0	0	0	0

ZONAL LUMENS

	Lumens
Zone	
0	
0-10	233
10-20	787
20-30	1216
30-40	951
40-50	329
50-60	93
60-70	19
70-80	10
80-90	8
90	

LUMINANCE DATA (cd/m²)

	Horizontal Angles		
Vertical Angle	0	45	90
45	4597	15642	10171
55	949	2223	7334
65	219	521	807
75	110	208	312
85	77	154	212

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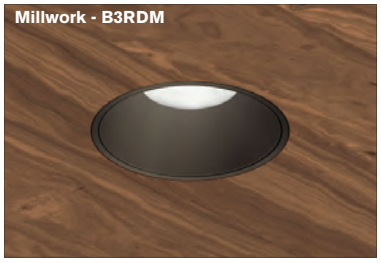
BeveLED Mini® Basic - B3RD-L2
3″ Round Downlight

USAI® Lighting

Field changeable between Trimmed / Trimless / Millwork



usailighting.com/minibasic

Introducing BeveLED Mini Basic, our newest LED downlight to deliver consistently classic white light with the same below ceiling appearance as our BeveLED Mini product line.

FEATURES

- 2700K, 3000K, or 3500K color temperature options
- Downlight, wallwash and adjustable accent configurations
- Dry/damp/wet location rated for bathrooms and showers
- All of USAI's dimming driver options including 0-10V, digital, and phase dimming
- All housings are field convertible from trimless or millwork to trimmed installations in the field

DOWNLIGHT PERFORMANCE DATA

DELIVERED* PERFORMANCE:	Classic White 9W	15W
Source Lumens:	1075	1575
Lumens Per Watt:	83	77
Delivered Lumens:	825	1200
Color Consistency:	2-Step MacAdam Ellipse	

*Based on 3000K, 80+ CRI. Performance varies for each specific beamspread and color temperature. See IES files for exact values at usailighting.com.

CORRELATED COLOR TEMPERATURE MULTIPLIER	Classic White 2700K		3000K		3500K	
Color Rendering Index:	80+	90+	80+	90+	80+	90+
Multiplier for Lumen Output:	0.98	0.81	1.00	0.84	1.02	0.98

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BeveLED Mini® Basic - B3RD-L2
3″ Round Downlight

USAI® Lighting

Specify fixture part number. (All boxes must be filled in to correctly order)

B3RD__										
Trim Style	**Wattage Options**	**LED Color Temperature Options**	**Beam Options**	**Lens Options**	**Bevel Trim Finish Options**	***Flange/ Millwork Collar Finish**	**Housing Options**	**Voltage Options** *Select one*	**Dimming Driver Options**	**Accessories (Optional)***
B3RDF 3" Round Downlight Overlap Flange **B3RDL** 3" Round Downlight Trimless Plaster Frame **B3RDM** 3" Round Downlight Trimless Millwork	**Classic White** **09L2** 9W LED **15L2** 15W LED	**27KS** 2700K, 80+ CRI **27KH** 2700K, 90+ CRI **30KS** 3000K, 80+ CRI **30KH** 3000K, 90+ CRI **35KS** 3500K, 80+ CRI **35KH** 3500K, 90+ CRI 2-Step MacAdam Ellipse Color Consistency is standard for all	**20** 20° beam **30** 30° beam **50** 50° beam	**S** Solite (provided standard) **BF** Borosilicate Frosted	**WH** White **SC** Conduit Silver **GR** Grey **BL** Black **BZ** Bronze **PR** Primer Finish **AC** Clear Matte Anodized **AB** Piano Gloss Black **RAL** Custom Color Specify RAL #	**WH** White **SC** Conduit Silver **GR** Grey **BL** Black **BZ** Bronze **PR** Primer Finish **AC** Clear Matte Anodized **WH** White **BL** Black **GR** Grey **BZ** Bronze **AB** Piano Gloss Black **WH** White **GR** Grey **BL** Black **BZ** Bronze **RAL** Custom Color Specify RAL # *Leave blank for Trimless	**EC** Mini Basic New Construction **NC1** Universal New Construction Housing **NCIC** New Construction Insulation Contact Rated / Airtight **NCCP** Chicago Plenum	**UNV** 120V-277V **120V**	***For use with Universal Voltage 120V - 277V*** **D22** 0-10V dim, 1% (provided standard) **D4A** Lutron ECO, 0.1% (1) **D4P** Lutron ECO, 1% (1) **D6A** EldoLED 0-10V, 0.1% (1) **D6B** EldoLED 0-10V, 0.1% (1) **D6E** EldoLED 0-10V, 1% (1) **D6F** EldoLED 0-10V, 1% (1) **D7** EldoLED DALI, 0.1% (1) ***For use with 120V only*** **D3** Lutron 2-wire, 1% (1) **D19** Phase 2-wire, 1% (1) **D21** ERP Phase dimming, 1% *1 Not available with 9W LED* *2 Available with NC1 housing only.*	**CB27** 27" C-Channel Bars **CB52** 52" C-Channel Bars **EM** Emergency Battery, Dry/Damp Only (2) **EMW** Emergency Battery, Wet Location (2) *Residential grade nailer bars provided standard

TRIM FINISH OPTIONS


White - WH


Grey - GR


Black - BL


Bronze - BZ

Primer finish and custom colors also available

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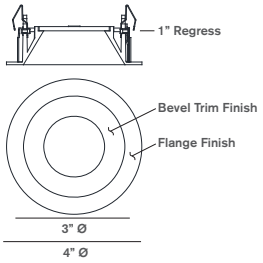
BeveLED Mini® Basic - B3RD-L2
3” Round Downlight

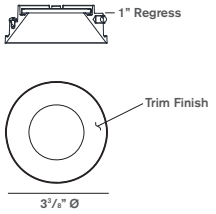
USAI® Lighting

TRIM DETAILS

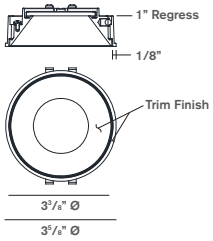
Trimmed - B3RDF



Trimless - B3RDL



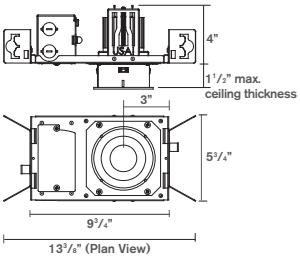
Millwork - B3RDM



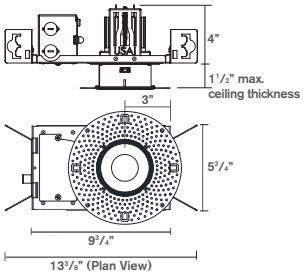
HOUSING OPTIONS

Trimmed - B3RDF

Mini Basic
New Construction Housing - EC

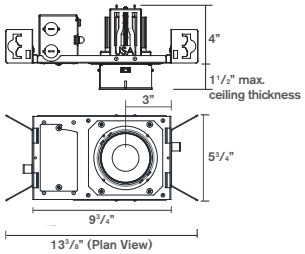


Universal New Construction Housing - NC1
Insulation-Contact Rated/Airtight - NCIC
Chicago Plenum Housing - NCCP

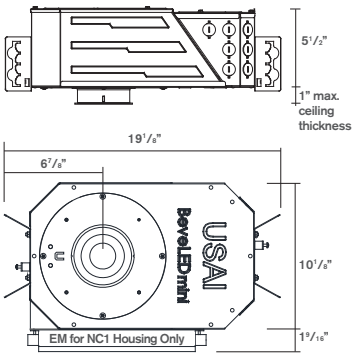


Trimless - B3RDL

Mini Basic
New Construction Housing - EC

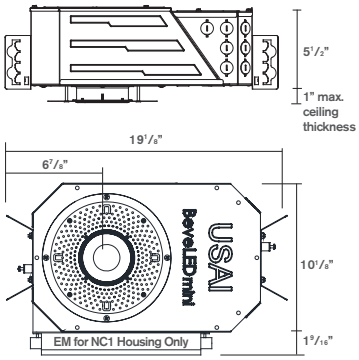


Universal New Construction Housing - NC1
Insulation-Contact Rated/Airtight - NCIC
Chicago Plenum Housing - NCCP

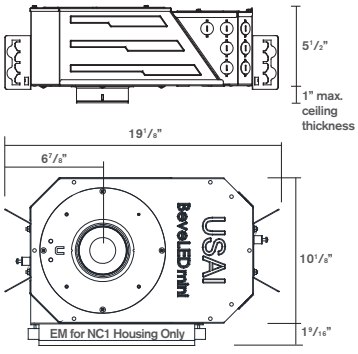


Millwork - B3RDM

Mini Basic
New Construction Housing - EC



Universal New Construction Housing - NC1
Insulation-Contact Rated/Airtight - NCIC
Chicago Plenum Housing - NCCP



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BeveLED Mini® Basic - B3RD-L2
3″ Round Downlight

USAI® Lighting

BEVELED MINI BASIC SPECIFICATIONS

FIELD REPLACEABLE LED LIGHT ENGINE
is serviceable through the aperture with a Philips screwdriver. All USAI Lighting light engines feature industry-leading color consistency within a 2-Step MacAdam Ellipse.

FIELD REPLACEABLE DRIVER
Unless otherwise specified, a 0-10V, 100%-1% solid state electronic constant current integral D22 dimming driver with a high power factor is provided standard and sources 2mA. All dimming drivers are serviceable from below the ceiling through the aperture and comply with IEEE C62.41 surge protection.

EMERGENCY
Emergency housing fixtures are provided with a remote test switch with a 24" lead length for location of the test switch. Emergency battery requires above ceiling access for service.

FIXTURE WEIGHT
BeveLED Mini Basic standard EC housing with trim weighs 5 lbs. NC1, NCIC and NCCP housings weigh 11 lbs each. NC1 housing with EM battery weighs 15 lbs.

HOUSING
Fabricated of 20 ga. steel construction with thru wire J-box, 4 in 4 out at min. 90°C, #12 AWG thru branch circuit wiring.

MOUNTING
B3RDF overlap flange fixtures are designed for use in sheetrock, acoustical ceiling tile, and many other ceiling materials. B3RDL plaster frame fixtures are provided with a spackle collar and are designed for use in sheetrock/mud-in ceiling applications. B3RDM millwork fixtures are provided with a millwork collar in finish to match trim finish specified and are designed for use in wood/millwork construction applications. Butterfly brackets and adjustable nailer bars extendible from 14" to 24" centers with integral nails are provided for attachment to building structure. C-channel bars are optionally available for acoustical ceiling applications.

WARRANTY
Based on IESNA LM80-2008, BeveLED Mini Basic has a 50,000 hour rated life at 70% lumen maintenance (L70). USAI Lighting Warranty covers replacement parts for 5 years from date of shipment.

CEILING CUT OUT
B3RDF Overlap Flange: 3-5/8" Ø
B3RDP Plaster Frame: 4-3/16" Ø
B3RDM Millwork: 3-5/8" Ø

MAXIMUM CEILING THICKNESS
As noted on housing drawings

LISTINGS
Dry/Damp/Wet location. AC and AB trim finishes are dry/damp only. EM test switch is dry/damp only. Select EMW option for wet location remote test switch. UL2043 rated for use in air handling plenums. Not for use in fire-rated installations. NRTL/CSA-US tested to UL standards. IBEW union made.

NOTES
- Not for use in corrosive environment
- Use of pressure washer voids warranty

PHOTOMETRICS
Consult factory or website for IES files. Tested in accordance with IESNA LM79.

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D3 / DIML3

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

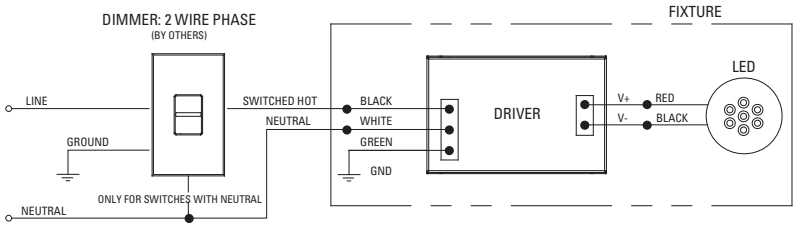
D3 / DIML3 LED: Lutron Hi-Lume A-Series 2 Wire Fwd Phase (with neutral) / LED Dimming Driver Wiring (Dims down to 1%) 120V

D3 / DIML3 Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Dimmer* Fixture Wattage	
120V Only				39W and Less	40W - 80W
ETC	Sensor+ Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
ETC	Unison DRd Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
Lutron	Maestro Wireless® 600W dimmer	MRF2-6ND-120-	100% - 1%	1 – 8	1 – 4
Lutron	Maestro Wireless® 1000W dimmer	MRF2-10ND-120-	100% - 1%	1 – 13	1 – 6
Lutron	HomeWorks® QS adaptive dimmer	HQRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 600W dimmer	HQRD-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 1000 W dimmer	HQRD-10ND-	100% - 1%	1 – 13	1 – 6
Lutron	Caseta Wireless® Pro 1000W dimmer	PD-10NXD-	100% - 1%	1 – 13	1 – 6
Lutron	Stanza® dimmer	SZ-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 adaptive dimmer	RRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 1000 W dimmer	RRD-10ND-	100% - 1%	1 – 6	1 – 3
Lutron	myRoom DIN power module	MQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® QS wallbox power module	HQRJ-WPM-6D-120-	100% - 1%	1 – 26	1 – 13
Lutron	Homeworks® DIN power module	LQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® wallbox power module	HWI-WPM-6D-120	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® QS control unit	QSGR-, QSGRJ-	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® 3000 control unit	GRX-3100-, GRX-3500-	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4U module	HW-RPM-4U-120, LP-RPM-4U-120	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4A module	HW-RPM-4A-120, LP-RPM-4A-120	100% - 1%	1 – 26	1 – 13
Lutron	GP dimming panels	Various	100% - 1%	1 – 26	1 – 13
Lutron	Ariadni CL 250W dimmer	AYCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Diva CL 250W dimmer	DVCL-253P-, DVSCCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Grafik T CL or RF CL dimmer	GT-250M-, GTJ-250M-	100%-1%	1 – 8	1 – 4
Lutron	Nova T CL 250W dimmer	NTCL-250-	100%-1%	1 – 10	1 – 5

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

D3 / DIML3
2 WIRE PHASE DIMMING



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info@usailighting.com
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New Windsor, NY 12553
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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D4A / DIML4A and D4P / DIML4P

DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

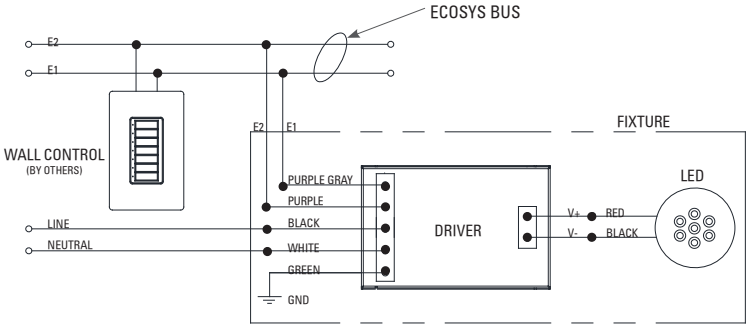
D4A / DIML4A LED: Lutron Hi-Lume Premier EcoSystem LED Driver (Dims down to 0.1%)
D4P / DIML4P LED: Lutron Hi-Lume Premier EcoSystem LED Driver (Dims down to 1%)

D4A / D4P EcoSystem Controls Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Maximum Quantity Light Fixtures Per Control
120V / 277V			
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	32
		FCJ/FCJS-ECO	3
120V ONLY			
Lutron	Energi Savr Node	QSN-1ECO-S	64
		QSN-2ECO-S	128
	GRAFIK Eye QS/ Homeworks QS control unit	QSGRJ-_E, QSGR-_E	64
	Quantum Hub	QP2-__2C	128
		QP2-__4C	256
		QP2-__6C	384
		QP2-__8C	512
	HomeWorks QS / myRoom Plus power module	LQSE-2ECO-D	128

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

D4A / DIML4A and D4P / DIML4P
EcoSystem CONTROLS



USAI Lighting
www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D6A / DIML6A and D6E / DIML6E
D6B / DIML6B and D6F / DIML6F

IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D6A / DIML6A and D6E / DIML6E LED Dimming Compatibility Table

D6A / DIML6A and D6E / DIML6E are linearly programmed dimming drivers for use with the dimming controls listed in the table below.
D6A / DIML6A = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1%
D6E / DIML6E = EldoLED ECOdrive 0-10V control dims from 100% to 1%

D6A / DIML6A and D6E / DIML6E Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range DIML6A		6E	Qty Fixtures Per Dimmer*
120V & 277V						Refer to manufacturer's dimmer load rating for maximum and minimum fixture quantities per dimmer. Enlighted compatible.
Lutron	Diva	DVTV/NFTV with PP-20	99% -	0.1%	1%	
Lutron	Nova T	NTFTV with PP-20	99% -	0.1%	1%	
Lutron	Energi Savr Node	QSN-4T16-S	100% -	0.1%	1%	
Lutron	GP Dimming Panels	TVM2 Module	99% -	0.1%	1%	
Lutron	Interfaces	GRX-TVI w/ GRX3503	100% -	0.1%	1%	
Sensor Switch	nIO	nIO EZ	100% -	0.1%	1%	
enlighted	Control Unit	CU-3E-1R	100% -	0.1%	1%	

D6B / DIML6B and D6F / DIML6F LED Dimming Compatibility Table

D6B / DIML6B and D6F / DIML6F are logarithmic-programmed dimming drivers for use with the dimming controls listed in the table below.
D6B / DIML6B = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1% D6F / DIML6F = EldoLED ECOdrive 0-10V control dims from 100% to 1%

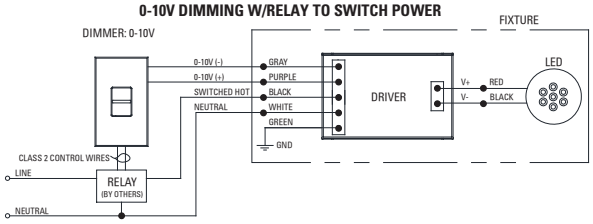
D6B / DIML6B and D6F / DIML6F Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range DIML6B		6F	Qty Fixtures Per Dimmer*
120V & 277V						Refer to manufacturer's dimmer load rating for maximum and minimum fixture quantities per dimmer. Enlighted compatible.
Bush-Jaeger	Electronic potentiometer	2112U-101	100% -	0.1%	1%	
Jung	Electronic potentiometer	240-10	100% -	0.1%	1%	
Leviton	Iluma Tech dimmer	IP710-DLX	100% -	0.1%	1%	
Lightolier (Philips)	Momentum (120V ONLY)	ZP600FAM120	100% -	0.1%	1%	
Merten	Electronic potentiometer	5729	100% -	0.1%	1%	
Pass & Seymour	Titan	CD4FB-W	100% -	0.1%	1%	
Watt Stopper	Miro	DCLV1	100% -	0.1%	1%	
Synergy	Wallbox Dimmers	ISD BC	100% -	0.1%	1%	
ABB	i-bus	SD/S 2.16.1	100% -	0.1%	1%	
Crestron	Modules	GLX-DIMFLV8, GLXP-DIMFLV8	100% -	0.1%	1%	
Crestron	Green Light	GLPAC-DIMFLV4-, GLPAC-DIMFLV8-	100% -	0.1%	1%	
Crestron	Green Light Power Pack	GLPP-DIMFLVEX-PM, GLPP-1DIMFLV2EX-PM, GLPP-1DIMFLV3EX-PM	100% -	0.1%	1%	
Crestron	DIN Rail Analog Output Module	DIN-A08	100% -	0.1%	1%	
Crestron	DIN Rail 0-10V Fluorescent Dimmer	DIN-4DIMFLV4	100% -	0.1%	1%	
Crestron	iLux 0-10V Dimmer Expansion Module	CLS-EXP-DIMFLV	100% -	0.1%	1%	
enlighted	Control Unit	CU-3E-1R	100% -	0.1%	1%	

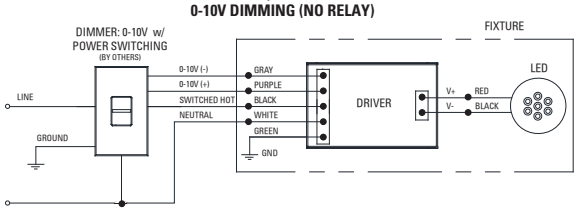
DIMMING DRIVER WIRING SCHEMES:

NOTES: Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

D6 / DIML6
0-10V DIMMING W/RELAY TO SWITCH POWER



D6 / DIML6
0-10V DIMMING (NO RELAY)



USAI Lighting
www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D7 / DIML7 and D7E

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

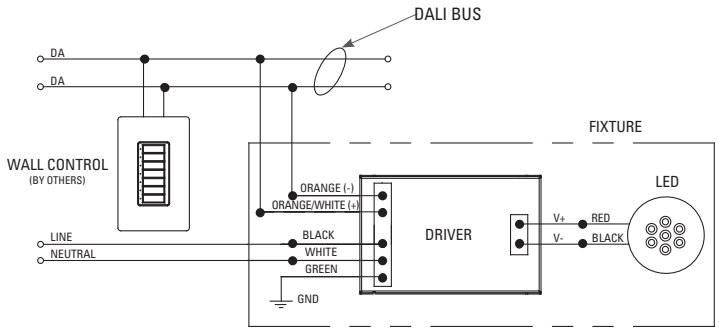
IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D7 / DIML7 and D7E Dimming Driver Wiring

D7 / DIML7 and D7E are linearly programmed dimming drivers.
D7 / DIML7 = EldoLED SOLOdrive DALI control dims from 100% to 0.1%
D7E = EldoLED ECOdrive DALI control dims from 100% to 1%

D7 / DIML7 / D7E
DALI CONTROLS



USAI Lighting
www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D19 / DIML19

DIMMING DRIVER WIRING SCHEMES:

NOTES:

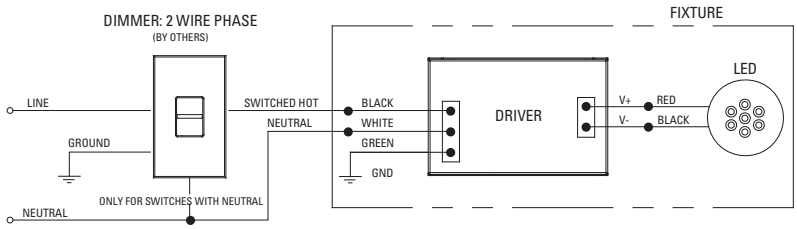
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D19 / DIML19 LED: Hatch XTC series or equivalent - Forward and Reverse Phase Dimming Driver. Dims down to 1% contingent upon dimmer specification and load. 120V only.

D19 / DIML19
2 WIRE PHASE DIMMING



D19 / DIML19 Dimmer Compatibility Chart

120V ONLY		
Forward Phase / TRIAC Dimming		
Manufacturer	Product	Qty Fixtures Per Dimmer
Leviton	IPL06-10Z	Use fixture wattage per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
	6613-xxx	
Lutron	S-600P	
	S-603P	
	DV-600P	
	DV-603P	
	DVSC-603P	
	CT-600P	
	CT-603P	

120V ONLY		
Reverse Phase / ELV Dimming		
Manufacturer	Product	Qty Fixtures Per Dimmer
Leviton	6615	Use fixture wattage per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
	IPE04-xxx	
Lutron	NTELV-300	
	NTELV-600	
	SELV-300P	
	SELV-303P	
	DVELV-300P	
	DVELV-303P	

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www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D21

DIMMING DRIVER WIRING SCHEMES:

NOTES:

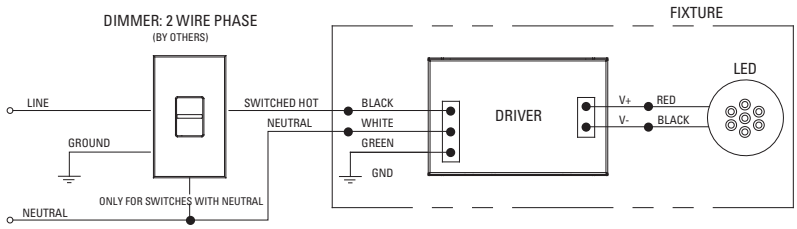
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D21 LED: ERP EBR015 series or equivalent - Forward and Reverse Phase Dimming Driver.
Dims down to 1% contingent upon dimmer specification and load (see compatibility chart below). 120V only.

D21
2 WIRE PHASE DIMMING



D21 Dimmer Compatibility Chart

120V ONLY PHASE DIMMING				
Dimmer Information		Dimming Range		Qty Fixtures
Manufacturer	Product	Maximum	Minimum	Per Dimmer
Cooper	DAL06P	100%	0%	Use fixture wattage per fixture specification sheet to determine maximum number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating per dimmer specification sheet.
	DLC03P	100%	0%	
	SLC03P	100%	0%	
Leviton	6161	99%	10%	
	6631-2	100%	0%	
	6633-P	100%	0%	
	6673-10W	99%	6%	
	6683-IW	100%	2%	
	IPE04	100%	3%	
	IPI06-1LZ	99%	0%	
	VPE06	100%	5%	
Lightolier	ZP260QEW	99%	3%	
Lutron	CT103P	99%	6%	
	DV600P	99%	3%	
	DVCL-153P	99%	0%	
	DVELV303P	97%	3%	
	FAELV500	99%	7%	
	LG600P	99%	5%	
	MAELV600	99%	7%	
	S600P	99%	1%	
	S-603PG	86%	4%	
	SELV300P	97%	3%	
	TG-600P	99%	13%	
	TGCL-153P	99%	2%	

www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D22

DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

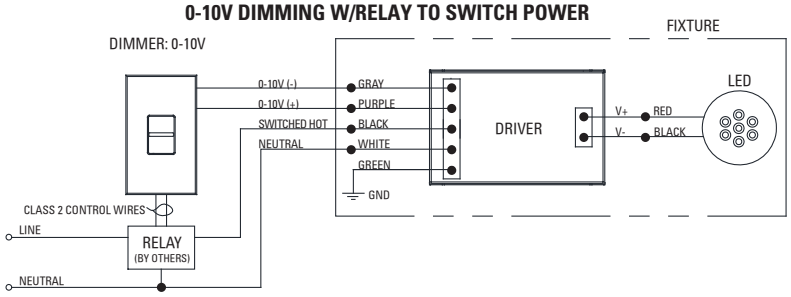
D22 LED: ERP ESS 0-10V Dimming Driver Wiring (Dims down to 1%)

D22 Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Dimmer*
120V / 277V				Use source current per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
Crestron	iLux dimmer expansion module	CLS-EXP-DIMFLV	100% - 1%	
Crestron	DIN Rail dimmer	DIN-4DIMFLV4	100% - 1%	
Crestron	DIN Rail analog output module	DIN-A08	100% - 1%	
Crestron	8 Channel dimmer module	GLX-DIMFLV8	100% - 1%	
Crestron	8 Channel dimmer module	GLXP-DIMFLV8	100% - 1%	
Leviton	IllumaTech dimmer	IP710-DLX	100% - 1%	
Lutron	Nova T	NFTV-XX	100% - 1%	
Lutron	Diva	DVTV-XX	100% - 1%	

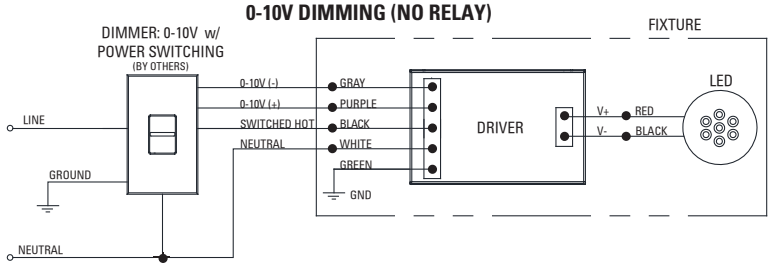
* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

D22
0-10V DIMMING W/RELAY TO SWITCH POWER



NOTE:
If switched, non-dimming operation is desired, cap off purple and gray wires individually at installation. Do NOT cap purple and gray wires together.

D22
0-10V DIMMING (NO RELAY)



NOTE:
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USAI Lighting
www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE

D22 Continued

DIMMING DRIVER WIRING SCHEMES:

NOTES:

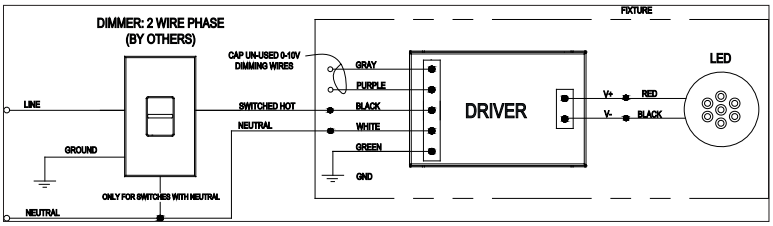
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D22 LED: ERP ESS series or equivalent - Forward and Reverse Phase Dimming Driver.
Dims down to 1% contingent upon dimmer specification and load (see compatibility chart below). 120V only.

D22
2 WIRE PHASE DIMMING



D22 Dimmer Compatibility Chart

120V ONLY PHASE DIMMING				
Dimmer Information		Dimming Range		Qty Fixtures
Manufacturer	Product	Maximum	Minimum	Per Dimmer
Cooper	DAL06P	100%	0%	Use fixture wattage per fixture specification sheet to determine maximum number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating per dimmer specification sheet.
	DLC03P	100%	0%	
	SLC03P	100%	0%	
Leviton	6161	99%	10%	
	6631-2	100%	0%	
	6633-P	100%	0%	
	6673-10W	99%	6%	
	6683-IW	100%	2%	
	IPE04	100%	3%	
	IPI06-1LZ	99%	0%	
	VPE06	100%	5%	
Lightolier	ZP260QEW	99%	3%	
Lutron	CT103P	99%	6%	
	DV600P	99%	3%	
	DVCL-153P	99%	0%	
	DVELV303P	97%	3%	
	FAELV500	99%	7%	
	LG600P	99%	5%	
	MAELV600	99%	7%	
	S600P	99%	1%	
	S-603PG	86%	4%	
	SELV300P	97%	3%	
	TG-600P	99%	13%	
	TGCL-153P	99%	2%	

www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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T-BAR LED Diffusing Lens | Order Specification Guide

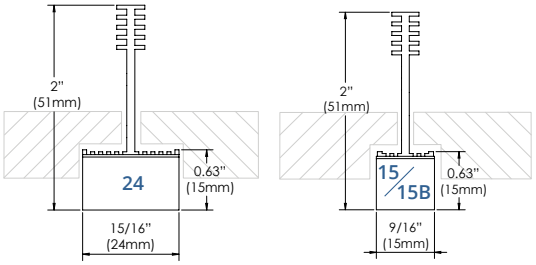
T-BAR LED®

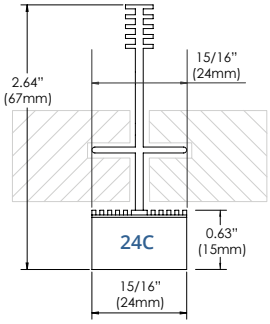
Product Name	Type of LED/K Color	Size	Grid Type	Optic	Mounting Clips	Color	Options
TBSL = T-BAR LED	HW = 3000K MW = 3500K MN = 4000K HN = 4500K TU = 2700–5000K tunable	2 = 2 ft 4 = 4 ft 5 = 5 ft 4L = 4 ft L 6 = 60 cm 12 = 120 cm 12L = 120 cm L	24 = 15/16" 15 = 9/16" 15B = 9/16" Bolt Slot 24C = 15/16" Partially Concealed Grid	D = Diffusing Lens	U = Universal A = Armstrong C = Custom	W = White C = Custom	CP = Chicago Plenum rated IP65 = IP65 rated POE = Power over Ethernet*

www.jlc-tech.com/patents

*Consult factory for POE

Profile Dimensions
(Compatible with Tegular and Lay-in tiles)





Length Dimensions

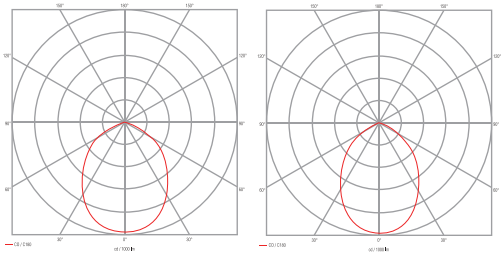
Size	Grid Type	X	Y
2 = 2ft	24 = 15/16"	24"	23"
4 = 4ft	24 = 15/16"	48"	47"
5 = 5ft	24 = 15/16"	60"	59"
4L = 4ft L	24 = 15/16"	48"	24"
2 = 2ft	15 = 9/16"	24"	23.4"
4 = 4ft	15 = 9/16"	48"	47.4"
5 = 5ft	15 = 9/16"	60"	59.4"
4L = 4ft L	15 = 9/16"	48"	24"

CRI = >82 L_{80} > 60K hrs IP40

LIGHT OUTPUT:

15/16" - 584lm per foot
75lm/W

9/16" - 445lm per foot
54 lm/W



15/16" Diffusing Lens 9/16" Diffusing Lens

NOTES:
T-BAR LED modules can be parallel connected up to 12 linear feet max per power supply. Remote power supply includes JB compartment for AC input direct wiring with metal conduit. Max distance from power supply to fixtures is 30 feet with 18 AWG wire. Longer distance achievable if using higher gauge wire. IP65 and Chicago Plenum optional ratings available, (see page 19).

APPLICATIONS:
Executive, Medical, Health, Educational, Retail, Hotels, Airport, Hospitality and any open space areas that require a unique and elegant architectural lighting design.

MOUNTING:
Universal mounting brackets are for easy installation to standard 15/16" or 9/16" T-Bars of most manufacturers' ceiling suspension systems. Armstrong compatible mounting clips for installation with Armstrong Ceiling 15/16" Prelude® and Clean Room™, 9/16" Suprafine®, Silhouette®, Sonata® and Interlude® suspension systems. Compatible with Tegular and Lay-in tiles.

MATERIALS:
Anodized and painted aluminum extruded body, steel mounting clips, white PC end caps, high transmitting acrylic PMMA lens.

ELECTRIC:
High output LEDs consume 16W total (2 foot) or 32W total (4 foot) or 40W total (5 foot). Power supply consumption not included. Input voltage 24VDC. Class 2 plenum rated cables at each end equipped with quick connectors to allow multiple modules to be easily connected together (max 12 linear feet of product). Use solid copper wire or wire ferrules to fit into quick connectors. POE options available, consult factory.

WARRANTY:
5 years

LISTINGS:
ETL/cETLus CE RoHS. Indoor use only. IC Rated.

hpd VERSION 2.2

MADE IN USA

JLC-Tech LLC | Pembroke, MA | info@jlc-tech.com | www.jlc-tech.com

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T-BAR LED Remote Drivers | Order Specification Guide

T-BAR LED® T-BAR UP®

Product Name	Driver Type	Power	Wattage	Voltage
TBSL = T-BAR LED Power Supply	PS = Non Dimmable DIM = 1% Dimmable 0-10 VDC	HP = High Power	100W = 96W 200W = 192W 400W = 384W	UNV = Universal 100-277V

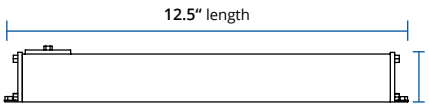
WARRANTY: 5 years

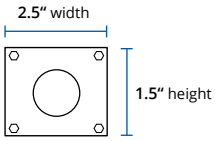
24VDC LED Driver 96W Power Supply

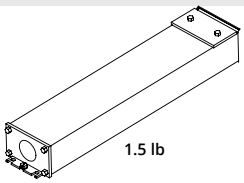
0-10 VDC dimmable and non dimmable

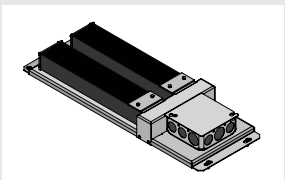
T-BAR LED and T-BAR UP modules can be parallel connected up to 12 linear feet max per power supply. Power supply includes JB compartment for AC input direct wiring with metal conduit.

96W Power Supply dimensions







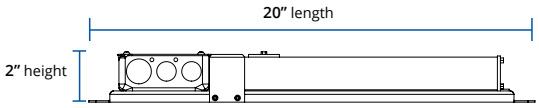


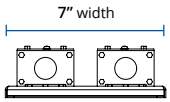
24VDC LED Driver 192W Power Supply

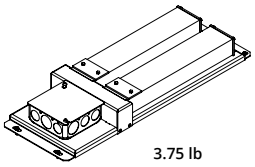
0-10 VDC dimmable and non dimmable

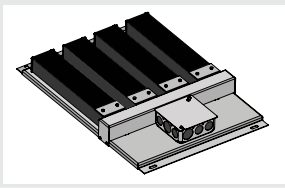
T-BAR LED and T-BAR UP modules can be parallel connected up to 12 linear feet max per channel totaling 24 linear feet of illuminated product. Power supply includes JB compartment for AC input direct wiring with metal conduit.

192W Power Supply dimensions







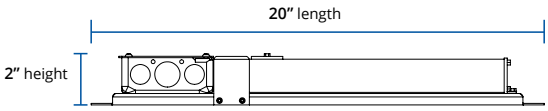


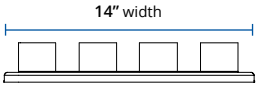
24VDC LED Driver 384W Power Supply

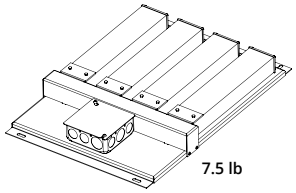
0-10 VDC dimmable and non dimmable

T-BAR LED and T-BAR UP modules can be parallel connected up to 12 linear feet max per channel totaling 48 linear feet of illuminated product. Power kit includes JB for AC input direct wiring with metal conduit.

384W Power Supply dimensions







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Type

R2

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BeveLED® 2.2
4.5″ Round Downlight - B4RD

USAI® Lighting

Universal and Field Convertible - Trim | Trimless | Millwork

Trimmed - B4RDF

Trimless - B4RDL

Millwork - B4RDM

usailighting.com/beveled

FEATURES

- Field Flexibility between trimmed, trimless and millwork
- Dry/damp/wet location rated for bathrooms and showers
- 1% dimming standard + more dimming options
- Clear overspray protector for installation convenience
- Full family platform
- Iconic beveled look

COMPANION FAMILY PRODUCTS

Trimless Acoustical - B4RDP
usailighting.com/B4RDP

Deep Regress - B4RC
usailighting.com/B4RC

Adjustable - B4RA
usailighting.com/B4RA

Wall Wash - B4RW
usailighting.com/B4RW

DOWNLIGHT PERFORMANCE DATA

DELIVERED* PERFORMANCE:	LED COLOR CHOICES									
	Classic White						Warm Glow Dimming		Color Select	
	9W	12W	16W	24W	33W	36W	16W	32W	16W	32W
Source Lumens:	1150	1300	1725	2400	3025	4150	1275	2150	1250	2075
Lumens Per Watt:	93	86	86	80	71	99	69	61	60	53
Delivered Lumens:	775	1025	1375	1925	2400	3450	1100	1800	950	1600
EM Mode Output:	575 Delivered Lumens (nominal)						450 Delivered Lumens		475 Delivered Lumens	

*Based on 3000K, 80+ CRI. Performance varies for each specific beamspread and color temperature. See IES files for exact values at usailighting.com.

CORRELATED COLOR TEMPERATURE MULTIPLIER	Classic White						Warm Glow Dimming				Color Select					
	2200K	2700K	2700K	3000K	3500K	4000K	2700K	2700K	3000K	3500K	2200K	2700K	3500K	4000K	5000K	6000K
Color Rendering Index:	80+	80+	90+	90+	80+	80+	80+	90+	90+	80+	80+	80+	80+	80+	80+	80+
Multiplier for Lumen Output:	0.72	0.94	0.78	0.78	1.00	1.06	0.94	0.74	0.80	1.07	0.87	0.96	1.04	1.09	1.13	1.18

THE COMPLETE BEVELED FAMILY PLATFORM

More Ceiling Applications

Sloped Ceiling

BeveLED Block

Cylinders

More Sizes and Shapes

BeveLED Micro

BeveLED Mini

BeveLED 5.0

Armstrong® Ceiling Solutions Compatible

Trimless Acoustical

Connect TechZone

BeveLED Connect

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BeveLED® 2.2
4.5″ Round Downlight - B4RD

USAI® Lighting

Specify fixture part number. (All boxes must be filled in to correctly order)

B4RD__

BeveLED Trim Style

F
Trimmed with Flange (use with all materials)

L
Trimless Spackle-in (use with sheetrock and plaster only)

M
Millwork Knife-Edge (use with wood and stone)

Wattage Options / LED Color Options / Beam Options

Classic White Light

Wattage Options	LED Color Options	Beam Options
09C3 9W LED	**22KS** (1) 2200K, 80+ CRI	**25** 25° beam
12C3 12W LED	**27KS** 2700K, 80+ CRI	**50** 50° beam
16C3 16W LED	**27KH** 2700K, 90+ CRI	**90** 90° beam
24C3 24W LED	**30KS** 3000K, 80+ CRI	
33C3 33W LED	**30KH** 3000K, 90+ CRI	
36E1 36W LED	**35KS** 3500K, 80+ CRI	
	35KH (8) 3500K, 90+ CRI	
	40KS 4000K, 80+ CRI	
	40KH (8) 4000K, 90+ CRI	

Warm Glow Dimming

Wattage Options	LED Color Options	Beam Options
16WG2 16W LED	**2722KS** 2700K-2200K, 80+ CRI	**30** 30° beam
32WG2 32W LED	**2722KH** 2700K-2200K, 90+ CRI	**50** 50° beam
	3022KS 3000K-2200K, 80+ CRI	**90** 90° beam
	3022KH 3000K-2200K, 90+ CRI	
	3522KS 3500K-2200K, 80+ CRI	

Color Select Tunable White

Wattage Options	LED Color Options	Beam Options
16CS1 16W LED	**6022KS** 6000K-2200K, Tunable White Light 80+ CRI	**40** 40° beam
32CS1 32W LED		**60** 60° beam
		90 90° beam

Lens Options

S
Solite (provided standard)

SF
Solite Frosted

BF
Borosilicate Frosted

Bevel Trim Finish Options / *Flange/ Millwork Collar Finish

Bevel Trim Finish Options	*Flange/ Millwork Collar Finish
WH White	**WH** White
GR Grey	**GR** Grey
BL Black	**BL** Black
BZ Bronze	**BZ** Bronze
PR Primer Finish	**PR** Primer Finish
AC Clear Matte Anodized	**AC** Clear Matte Anodized
	WH White
	GR Grey
	BL Black
AB Piano Gloss Black	**AB** Piano Gloss Black
	WH White
	GR Grey
	BL Black
RAL Custom Color Specify RAL #	**RAL** Custom Color Specify RAL #

*Leave blank for Trimless

Housing Options

FT
Flat Housing New Construction (3)

FTIC
Flat Housing IC-Rated (up to 16W maximum) (2, 3)

FTCP
Flat Housing Chicago Plenum (3)

NCSM
New Construction Narrow Width

NC
New Construction

NCCP
Chicago Plenum

NCIC
Insulation Contact Rated / Airtight (1)

Voltage Options
Select one

UNV
120V-277V

120V

347V

Dimming Driver Options

For use with Universal Voltage 120V - 277V

No Additional Charge

D6E
EldoLED 0-10V, 1% (provided standard)

D6F
EldoLED 0-10V, 1%

D4
Lutron 3-wire/ECO, 1%

D4E
Lutron 5 ECO, 5% (5)

D4H
Lutron H ECO, 1% Fade (5)

D6A
EldoLED 0-10V, 0.1%

D6B
EldoLED 0-10V, 0.1%

D7
EldoLED DALI, 0.1%

D18
Moons DMX, 1% (2, 3)

For use with 120V only

No Additional Charge

D19
Phase 2-wire, 1% (2, 3, 5, 6)

D3
Lutron 2-wire, 1% (4)

For use with 347V only

D15
0-10V dim, 1% 347V only (2, 3)

Acessories (Optional)

CB27
27" C-Channel Bars

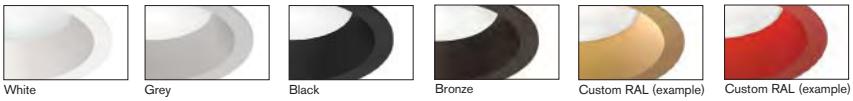
CB52
52" C-Channel Bars

EM
Emergency Battery (7)

EMW
Emergency Battery Wet Location (7)

Notes:
1 Not available with 36E1LED
2 Not available for Warm Glow.
3 Not available for Color Select.
4 Not available with 16W FTIC.
5 Not available with 9W.
6 Not available with 33W.
7 Not available with 347V. For NC and NCSM housings only. NCSM housing requires above ceiling access.
8 Not available with C3 LED

TRIM FINISH OPTIONS



White | Grey | Black | Bronze | Custom RAL (example) | Custom RAL (example)

Custom colors and primer finish also available

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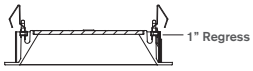
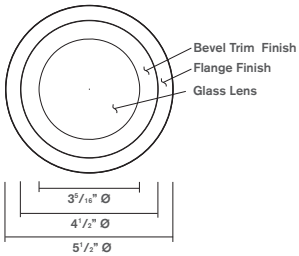
USAI® Lighting

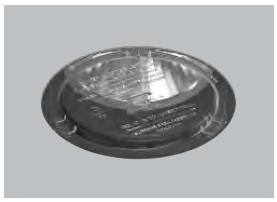
Trimmed - B4RDF

TRIM DETAILS

Trimmed - B4RDF





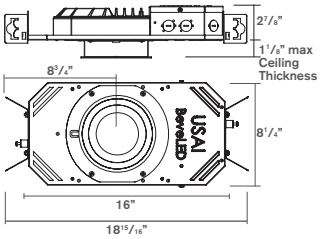


Clear acrylic overspray protector provided standard with every housing to keep out dust and contaminants during construction. Allows for use as work light.

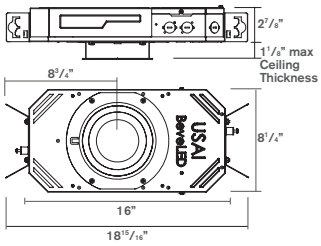
HOUSING OPTIONS

Flat Housing - FT

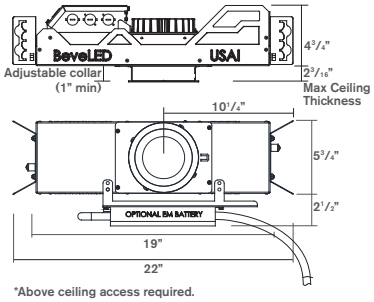
Flat Housing, Chicago Plenum - FTCP



Flat Housing, IC-Rated - FTIC
(up to 16W maximum)

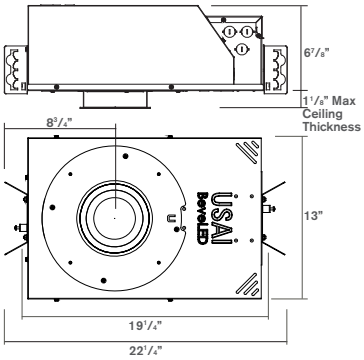


New Construction Narrow Width - NCSM
NCSM with Emergency Battery*

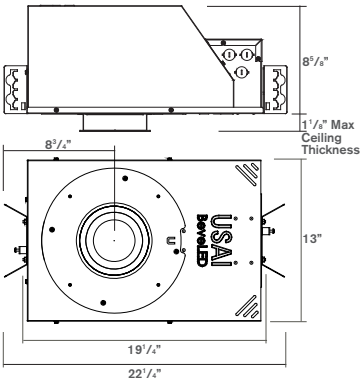


*Above ceiling access required.

New Construction - NC
Insulation-Contact Rated (24W Max) - NCIC
Chicago Plenum Rated (24W Max) - NCCP
NC with Emergency Battery



Insulation-Contact Rated (32W-33W) - NCIC
Chicago Plenum Rated (32W-36W) - NCCP



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Type

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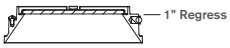
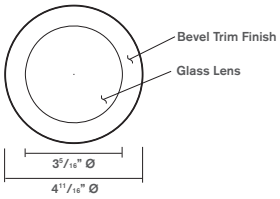
USAI® Lighting

Trimless - B4RDL

TRIM DETAILS

Trimless - B4RDL



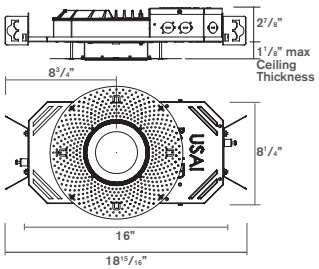


Clear acrylic overspray protector provided standard with every housing to keep out dust and contaminants during construction. Allows for use as work light.

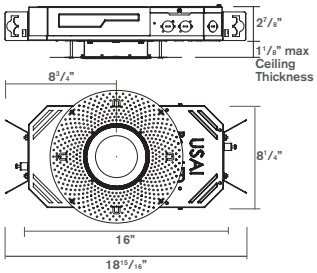
HOUSING OPTIONS

Flat Housing - FT

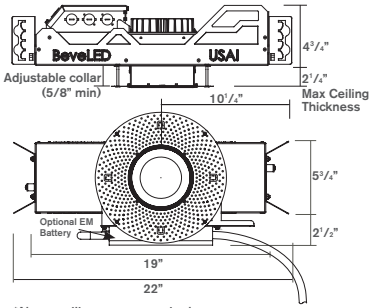
Flat Housing, Chicago Plenum - FTCP



Flat Housing, IC-Rated - FTIC
(up to 16W maximum)

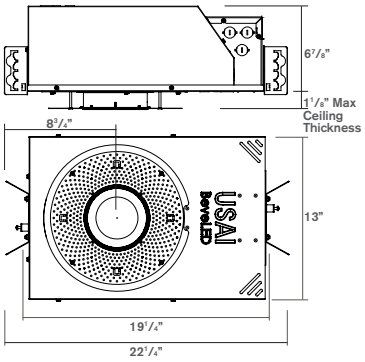


New Construction Narrow Width - NCSM
NCSM with Emergency Battery*

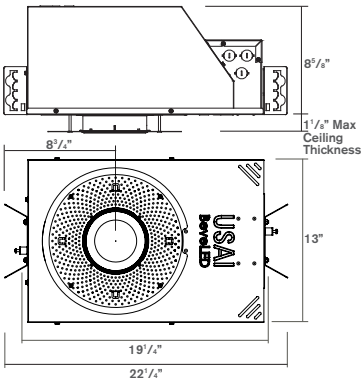


*Above ceiling access required.

New Construction - NC
Insulation-Contact Rated (24W Max) - NCIC
Chicago Plenum Rated (24W Max) - NCCP
NC with Emergency Battery



Insulation-Contact Rated (32W-33W) - NCIC
Chicago Plenum Rated (32W-36W) - NCCP



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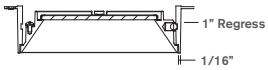
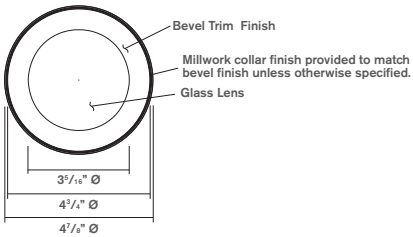
Millwork - B4RDM

TRIM DETAILS

Millwork - B4RDM



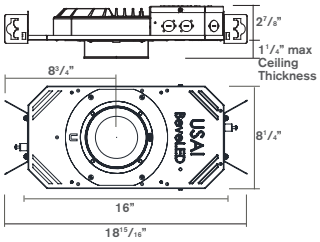


Clear acrylic overspray protector provided standard with every housing to keep out dust and contaminants during construction. Allows for use as work light.

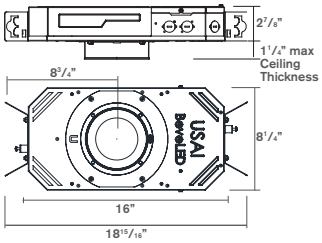
HOUSING OPTIONS

Flat Housing - FT

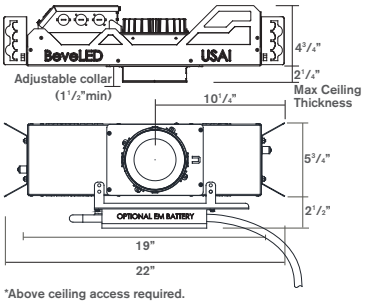
Flat Housing, Chicago Plenum - FTCP



Flat Housing, IC-Rated - FTIC
(up to 16W maximum)

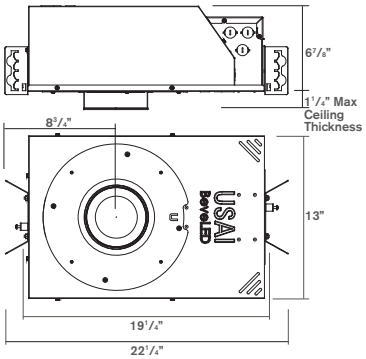


New Construction Narrow Width - NCSM
NCSM with Emergency Battery*

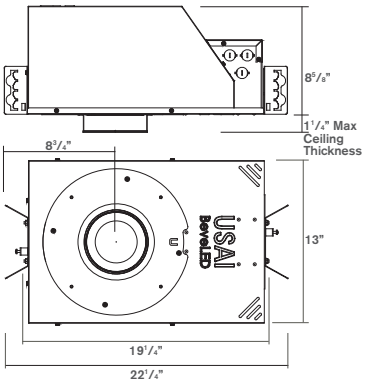


*Above ceiling access required.

New Construction - NC
Insulation-Contact Rated (24W Max) - NCIC
Chicago Plenum Rated (24W Max) - NCCP
NC with Emergency Battery



Insulation-Contact Rated (32W-33W) - NCIC
Chicago Plenum Rated (32W-36W) - NCCP



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BeveLED® 2.2
4.5″ Round Downlight - B4RD

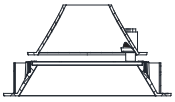
USAI® Lighting

BEVELED 2.2 SPECIFICATIONS

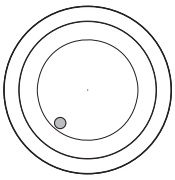
FIELD REPLACEABLE LED LIGHT ENGINE
is serviceable through the aperture without tools or with a Philips screwdriver. All USAI Lighting light engines feature industry-leading color consistency.

FIELD REPLACEABLE DRIVER
Unless otherwise specified, a 0-10V, 100%-1% solid state electronic constant current integral D6E dimming driver with a high power factor is provided standard and sources 2mA. All integral dimming drivers are located within the fixture housing and are serviceable from below the ceiling through the aperture. Some on-time delay may be experienced depending on control system used. All dimming drivers comply with IEEE C62.41 surge protection.

EMERGENCY BATTERY
IOTA emergency battery provides backup power for 90 minutes. NC EM fixtures are provided with an integral emergency battery with integral test switch for narrow and medium beamspreads and can be serviced through the aperture from below the ceiling plane. NC EM fixtures with 80° and 90° optics must be provided with remote test switches. NCSM EM fixtures are provided with an integral emergency battery with a remote test switch, which comes with a 24" lead length for location of the test switch. Remote EM test switch is dry/damp only; select EMW emergency option for a wet location-rated EM test switch. NCSM EM fixtures require above ceiling access for service of the EM pack. Fixtures that have no USAI EM option may be connected to an inverter (by others) for emergency lighting. Battery is not available with 347V.



Integral Emergency Test Switch included with NC housing with 25° - 60° optics



Remote Emergency Test Switch included with NCSM housing (above ceiling access required). Also included with NC housing when 80° and 90° optics are used.

HOUSING
All BeveLED 2.2 fixtures are field-felxible which allows for field changes from trimless or millwork to trimmed with a simple components change with parts from USAI. Housings are fabricated of 20 ga. steel construction with thru wire J-box, 4 in 4 out at min. 90°C, #12 AWG thru branch circuit wiring, except for NCSM which is fabricated of 18 ga. steel. FTIC and NCIC housing for use with 9W, 12W, and 16W light engines only are rated for direct contact with spray foam insulation of R-42 or less. FTIC housing is IC-rated up to 16W maximum, NCIC housing is IC-rated up to 33W maximum.

MOUNTING
B4RDF overlap flange fixtures are designed for use in sheetrock, acoustical ceiling tile, and many other ceiling materials. B4RDL trimless fixtures are provided with a spackle collar and are designed for use in sheetrock/mud-in ceiling applications. B4RDM millwork fixtures are provided with a millwork collar in finish to match trim finish specified and are designed for use in wood/millwork, stone and tile construction applications. Butterfly brackets and adjustable nailer bars extendible from 14" to 24" centers with integral nails are provided for attachment to building structure. C-channel bars are optionally available for acoustical ceiling applications.

FIXTURE WEIGHT
FT, FTIC, and FTCP housings weigh 8 lbs. NC, NCIC, and NCCP housings weigh 16 lbs. NCSM housing weighs 10 lbs., NCSM with EM weighs 16.5 lbs, and NC housing with EM weighs 24.5 lbs.

WARRANTY
Based on IESNA LM80-2008, BeveLED has a 50,000 hour rated life at 70% lumen maintenance (L70). USAI Lighting Warranty covers replacement parts for 5 years from date of shipment. Ambient temperatures at fixture location should not exceed 40°C during normal operation.

CEILING CUT OUT
B4RDF Trimmed with Overlap Flange: 5-1/16" ∅
B4RDL Trimless Spackle-in: 5-1/2" ∅
B4RDM Millwork Knife-edge: 4-15/16" ∅

LISTINGS
Dry/Damp/Wet location. AC and AB trim finishes are dry/damp only. Remote EM test switch is dry/damp only. Select EMW option for wet location remote test switch. UL2043 rated for use in air handling plenums. NRTL/CSA-US tested to UL standards. IBEW union made.

NOTES
- Not for use in corrosive environment
- Use of pressure washer voids warranty

PHOTOMETRICS
Consult factory or website for IES files. Tested in accordance with IESNA LM79.

USAI LIGHTING COLLABORATORY
13 Crosby Street
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845-234-4090
showroom@usailighting.com

USAI LIGHTING HEADQUARTERS
1126 River Road
New Windsor, NY 12553
T: 845–565–8500
info@usailighting.com

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USAI® Lighting

LED COLOR OPTIONS

Classic White Light

Our proprietary LED light engines achieve a 2-step MacAdam ellipse along the black body locus, resulting in reliable and uniform color from fixture to fixture. You'll see the results in consistently beautiful light throughout your space, whichever USAI LED product you specify.


Warm Glow® Dimming

Warm Glow Dimming provides warmth and glow once possible only in dimmed incandescent sources. Utilizing our patented proprietary algorithm and circuitry, Warm Glow Dimming technologies precisely mimic the black body curve of a standard 100W A19 lamp by gradually transitioning from 2700K , 3000K or 3500K down to 2200K. The result is virtually indistinguishable from an incandescent light source.


Color Select® Tunable White

Color Select represents the next innovation in color temperature control for advanced LED recessed downlighting. Color Select® products allow users to adjust color temperature from 6000K down to 2200K while independently adjusting intensity to achieve ultimate control over the quality of light in a space with a single fixture type. Color Select interfaces with standard dimming and control systems.


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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D3 / DIML3

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
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4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

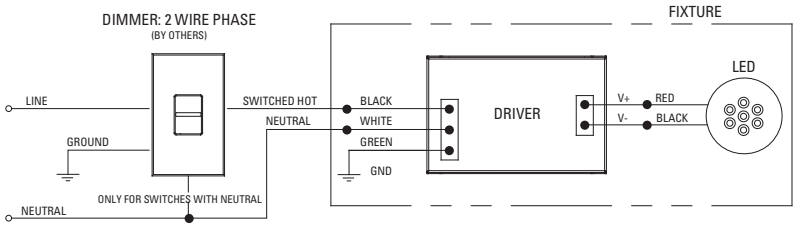
D3 / DIML3 LED: Lutron Hi-Lume A-Series 2 Wire Fwd Phase (with neutral) / LED Dimming Driver Wiring (Dims down to 1%) 120V

D3 / DIML3 Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Dimmer* Fixture Wattage	
120V Only				39W and Less	40W - 80W
ETC	Sensor+ Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
ETC	Unison DRd Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
Lutron	Maestro Wireless® 600W dimmer	MRF2-6ND-120-	100% - 1%	1 – 8	1 – 4
Lutron	Maestro Wireless® 1000W dimmer	MRF2-10ND-120-	100% - 1%	1 – 13	1 – 6
Lutron	HomeWorks® QS adaptive dimmer	HQRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 600W dimmer	HQRD-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 1000 W dimmer	HQRD-10ND-	100% - 1%	1 – 13	1 – 6
Lutron	Caseta Wireless® Pro 1000W dimmer	PD-10NXD-	100% - 1%	1 – 13	1 – 6
Lutron	Stanza® dimmer	SZ-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 adaptive dimmer	RRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 1000 W dimmer	RRD-10ND-	100% - 1%	1 – 6	1 – 3
Lutron	myRoom DIN power module	MQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® QS wallbox power module	HQRJ-WPM-6D-120-	100% - 1%	1 – 26	1 – 13
Lutron	Homeworks® DIN power module	LQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® wallbox power module	HWI-WPM-6D-120	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® QS control unit	QSGR-, QSGRJ-	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® 3000 control unit	GRX-3100-, GRX-3500-	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4U module	HW-RPM-4U-120, LP-RPM-4U-120	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4A module	HW-RPM-4A-120, LP-RPM-4A-120	100% - 1%	1 – 26	1 – 13
Lutron	GP dimming panels	Various	100% - 1%	1 – 26	1 – 13
Lutron	Ariadni CL 250W dimmer	AYCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Diva CL 250W dimmer	DVCL-253P-, DVSCCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Grafik T CL or RF CL dimmer	GT-250M-, GTJ-250M-	100%-1%	1 – 8	1 – 4
Lutron	Nova T CL 250W dimmer	NTCL-250-	100%-1%	1 – 10	1 – 5

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

D3 / DIML3
2 WIRE PHASE DIMMING



USAI Lighting

www.usailighting.com
info@usailighting.com

1126 River Road
New Windsor, NY 12553

T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE D4 / DIML4

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DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

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2. Only qualified electricians in accordance to local codes should install these fixtures.
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4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D4 / DIML4 LED: Lutron Hi-Lume A-Series LED Driver with 3-Wire FL Control / LED Dimming Driver Wiring (Dims down to 1%)

D4 / DIML4 3-Wire Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V Only				39W and Less	40W - 80W
ETC	Sensor+ Cabinet	D20 Dimming module	100% - 1%	1–53	1–26
ETC	Unison DRd Cabinet	D20F Dimming module	100% - 1%	1–53	1–26
Lutron	Nova T	NTF-10-	100%–1%	1–41	1 – 20
Lutron	Nova T	NTF-103P-	100%–1%	1–20	1 – 10
Lutron	Nova	NF-10-	100%–1%	1–41	1 – 20
Lutron	Nova	NF-103P-	100%–1%	1–20	1 – 10
Lutron	Vareo	VF-10-	100%–1%	1–20	1 – 10
Lutron	Skylark	SF-10P-, SF-103P-	100%–1%	1–20	1 – 10
Lutron	Diva	DVF-103P-, DVSCF-103P-	100%–1%	1–20	1 – 10
Lutron	Ariadni	AYF-103P-	100%–1%	1–20	1 – 10
Lutron	Vierti	VTF-6A-	100%–1%	1–15	1 – 7
Lutron	Maestro	MAF-6AM-, MSCF-6AM-	100%–1%	1–15	1 – 7
Lutron	Maestro Wireless	MRF2-F6AN-DV-	100%–1%	1–15	1 – 7
Lutron	RadioRA 2	RRD-F6AN-DV-	100%–1%	1–15	1 – 7
Lutron	HomeWorks QS	HQRD-F6AN-DV	100%–1%	1–15	1 – 7
Lutron	Interfaces	PHPM-3F-120, PHPM-3F-DV	100%–1%	1–41	1 – 20
Lutron	GP Dimming Panels	Various	100%–1%	1–41	1 – 20
277V Only				40W and Less	41W - 80W
ETC	Sensor+ Cabinet	D20 Dimming module	100% - 1%	1–53	1–26
ETC	Unison DRd Cabinet	D20F Dimming module	100% - 1%	1–53	1–26
Lutron	Nova T	NTF-10-277-	100%–1%	1–44	1 – 22
Lutron	Nova T	NTF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Nova	NF-10-277-	100%–1%	1–44	1 – 22
Lutron	Nova	NF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Skylark	SF-12P-277-, SF-12P-277-3	100%–1%	1–33	1 – 16
Lutron	Diva	DVF-103P-277-, DVSCF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Ariadni	AYF-103P-277-	100%–1%	1–44	1 – 22
Lutron	Vierti	VTF-6A-	100%–1%	1–33	1 – 16
Lutron	Maestro	MAF-6AM-277-, MSCF-6AM-277-	100%–1%	1–20	1 – 10
Lutron	Maestro Wireless	MRF2-F6AN-DV-	100%–1%	1–33	1 – 16
Lutron	RadioRA 2	RRD-F6AN-DV-	100%–1%	1–33	1 – 16
Lutron	HomeWorks QS	HQRD-F6AN-DV	100%–1%	1–33	1 – 16
Lutron	Interfaces	PHPM-3F-DV	100%–1%	1–88	1 – 44
Lutron	GP Dimming Panels	Various	100%–1%	1–88	1 – 44

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML4 wiring diagrams continued on next page

USAI Lighting
www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D4 / DIML4 Continued

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

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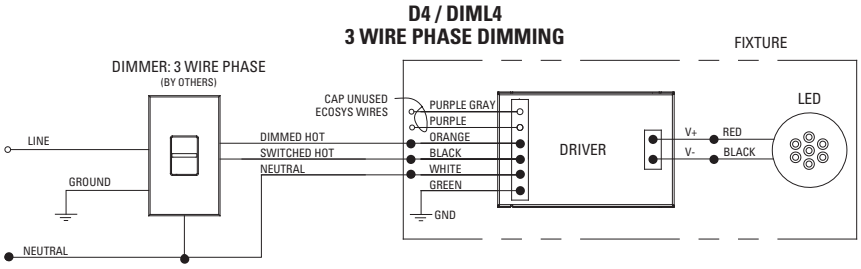
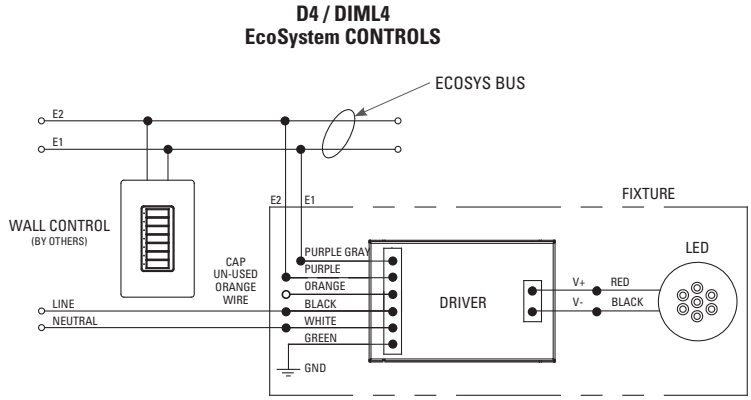
D4 / DIML4 LED: Lutron Hi-Lume A-Series LED Driver with 3-Wire FL Control / LED Dimming Driver Wiring (Dims down to 1%)



D4 / DIML4 LED: Lutron Hi-Lume A-Series LED Driver with EcoSystem Control / LED Dimming Driver Wiring (Dims down to

D4 / DIML4 EcoSystem Dimmer Compatibility Chart					
Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V / 277V				39W and Less	40W - 80W
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	100%–1%	1–32	1 – 16
Lutron	Energi Savr Node	QSN-1ECO-S, QSN-2ECO-S	100%–1%	1–64	1 – 32
Lutron	GRAFIK Eye QS (120V ONLY)	QSGRJ- E, QSGR- E	100%–1%	1–64	1 – 32
Lutron	Quantum	Various	100%–1%	1–64	1 – 32

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.



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info@usailighting.com
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New Windsor, NY 12553
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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D4E / DIML4E and D4H /DIML4H

DIMMING DRIVER WIRING SCHEMES:

NOTES:

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D4E / DIML4E LED: Lutron 5 Series EcoSystem LED Driver / LED Dimming Driver Wiring (Dims down to 5%)

D4E / DIML4E EcoSystem Dimmer Compatibility Chart					
Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V / 277V				39W and Less	40W - 80W
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	100%–5%	1–32	1 – 16
Lutron	Energi Savr Node	QSN-1ECO-S, QSN-2ECO-S	100%–5%	1–64	1 – 32
Lutron	GRAFIK Eye QS (120V ONLY)	QSGRJ- E, QSGR- E	100%–5%	1–64	1 – 32
Lutron	Quantum	Various	100%–5%	1–64	1 – 32

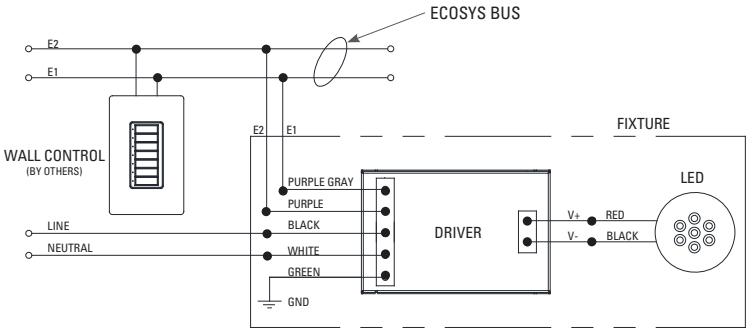
* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

D4H / DIML4H LED: Lutron H Series EcoSystem LED Driver with Fade to Black (dims down to 1%)

D4H / DIML4H EcoSystem Dimmer Compatibility Chart					
Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V / 277V				39W and Less	40W - 80W
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	100%–1%	1–32	1 – 16
Lutron	Energi Savr Node	QSN-1ECO-S, QSN-2ECO-S	100%–1%	1–64	1 – 32
Lutron	GRAFIK Eye QS (120V ONLY)	QSGRJ- E, QSGR- E	100%–1%	1–64	1 – 32
Lutron	Quantum	Various	100%–1%	1–64	1 – 32

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

D4E / DIML4E and D4H / DIML 4H EcoSystem CONTROLS



USAI Lighting

www.usailighting.com
info@usailighting.com

1126 River Road
New Windsor, NY 12553

T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D6A / DIML6A and D6E / DIML6E
D6B / DIML6B and D6F / DIML6F

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D6A / DIML6A and D6E / DIML6E LED Dimming Compatibility Table

D6A / DIML6A and D6E / DIML6E are linearly programmed dimming drivers for use with logarithmic-style dimming controls (e.g., Lutron and others listed in the table below)
D6A / DIML6A = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1%
D6E / DIML6E = EldoLED ECOdrive 0-10V control dims from 100% to 1%

D6A / DIML6A and D6E / DIML6E Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range DIML6A		DIML6E	Qty Fixtures Per Dimmer*
120V & 277V						Refer to manufacturer's dimmer load rating for maximum and minimum fixture quantities per dimmer. Enlighted compatible.
Lutron	Diva	DVTV/NFTV with PP-20	99% -	0.1%	1%	
Lutron	Nova T	NTFTV with PP-20	99% -	0.1%	1%	
Lutron	Energi Savr Node	QSN-4T16-S	100% -	0.1%	1%	
Lutron	GP Dimming Panels	TVM2 Module	99% -	0.1%	1%	
Lutron	Interfaces	GRX-TVI w/ GRX3503	100% -	0.1%	1%	
Sensor Switch	nIO	nIO EZ	100% -	0.1%	1%	
enlighted	Control Unit	CU-3E-1R	100% -	0.1%	1%	

D6B / DIML6B and D6F / DIML6F LED Dimming Compatibility Table

D6B / DIML6B and D6F / DIML6F are logarithmic-programmed dimming drivers for use with linear-style dimming controls (e.g., Crestron, non-Lutron and others listed below)
D6B / DIML6B = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1% D6F / DIML6F = EldoLED ECOdrive 0-10V control dims from 100% to 1%

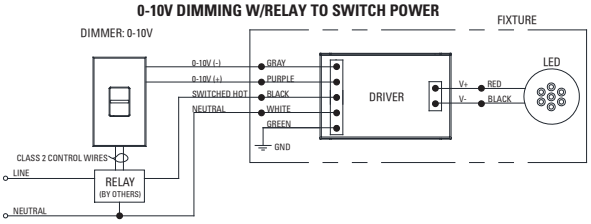
D6B / DIML6B and D6F / DIML6F Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range DIML6B		6F	Qty Fixtures Per Dimmer*
120V & 277V						Refer to manufacturer's dimmer load rating for maximum and minimum fixture quantities per dimmer. Enlighted compatible.
Bush-Jaeger	Electronic potentiometer	2112U-101	100% -	0.1%	1%	
Jung	Electronic potentiometer	240-10	100% -	0.1%	1%	
Leviton	Iluma Tech dimmer	IP710-DLX	100% -	0.1%	1%	
Lightolier (Philips)	Momentum (120V ONLY)	ZP600FAM120	100% -	0.1%	1%	
Merten	Electronic potentiometer	5729	100% -	0.1%	1%	
Pass & Seymour	Titan	CD4FB-W	100% -	0.1%	1%	
Watt Stopper	Miro	DCLV1	100% -	0.1%	1%	
Synergy	Wallbox Dimmers	ISD BC	100% -	0.1%	1%	
ABB	i-bus	SD/S 2.16.1	100% -	0.1%	1%	
Crestron	Modules	GLX-DIMFLV8, GLXP-DIMFLV8	100% -	0.1%	1%	
Crestron	Green Light	GLPAC-DIMFLV4-, GLPAC-DIMFLV8-	100% -	0.1%	1%	
Crestron	Green Light Power Pack	GLPP-DIMFLVEX-PM, GLPP-1DIMFLV2EX-PM, GLPP-1DIMFLV3EX-PM	100% -	0.1%	1%	
Crestron	DIN Rail Analog Output Module	DIN-A08	100% -	0.1%	1%	
Crestron	DIN Rail 0-10V Fluorescent Dimmer	DIN-4DIMFLV4	100% -	0.1%	1%	
Crestron	iLux 0-10V Dimmer Expansion Module	CLS-EXP-DIMFLV	100% -	0.1%	1%	
enlighted	Control Unit	CU-3E-1R	100% -	0.1%	1%	

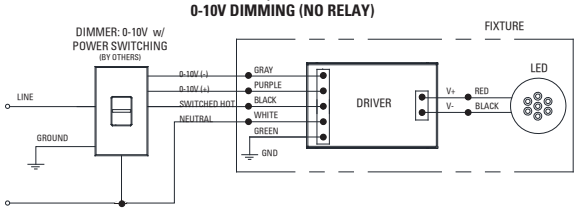
DIMMING DRIVER WIRING SCHEMES:

NOTES: Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

D6 / DIML6
0-10V DIMMING W/RELAY TO SWITCH POWER



D6 / DIML6
0-10V DIMMING (NO RELAY)



USAI Lighting
www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D7 / DIML7 and D7E

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

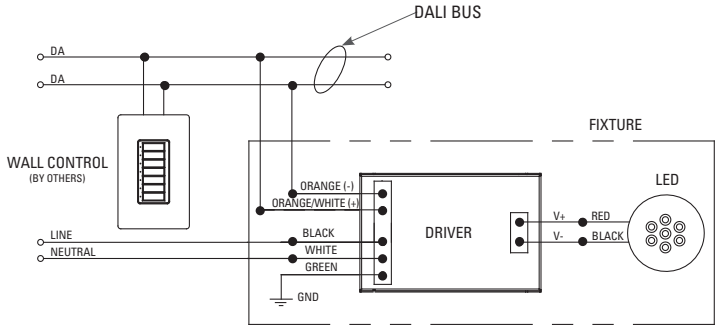
IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D7 / DIML7 and D7E Dimming Driver Wiring

D7 / DIML7 and D7E are linearly programmed dimming drivers.
D7 / DIML7 = EldoLED SOLOdrive DALI control dims from 100% to 0.1%
D7E = EldoLED ECOdrive DALI control dims from 100% to 1%

D7 / DIML7 / D7E
DALI CONTROLS



USAI Lighting
www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D8 / DIML8 and D8E

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D8 / DIML8 and D8E Dimming Driver Wiring

D8 / DIML8 and D8E are linearly programmed dimming drivers.
D8 / DIML8 = EldoLED POWERdrive DMX control dims from 100% to 0.1%
D8E = EldoLED POWERdrive DMX control dims from 100% to 1%

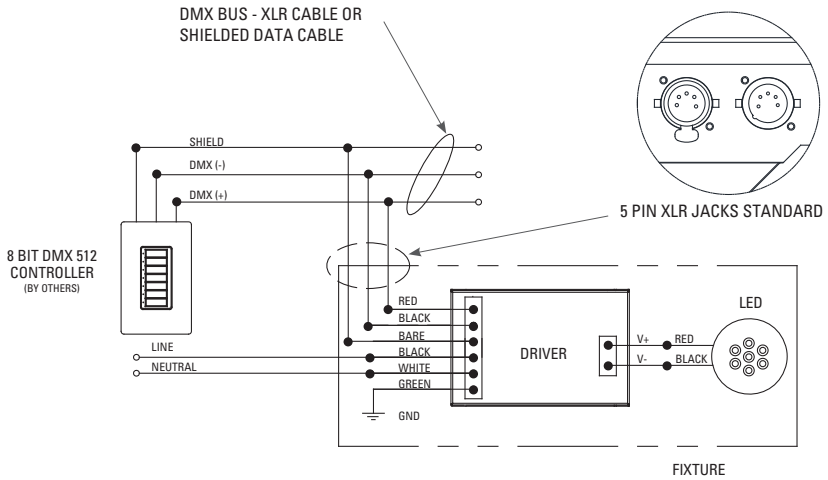
DMX BUS - XLR CABLE OR
SHIELDED DATA CABLE

The data cable used must meet the following requirements:

- type: shielded, 2-conductor twisted pair
- maximum capacitance between conductors: 30 pF/ft
- maximum capacitance between conductor and shield: 55 pF/ft
- maximum resistance: 0.02 ohms/ft
- normal impedance: 100-140 ohms
- conductive core: 24 AWG is recommended

If 3-wire data cables are preferred, we suggest a Belden 9841 or equivalent cable which meets the specifications for EIA RS-485 applications. Do not use standard microphone cables: they cannot transmit DMX512 data reliably over long distances. NOTE: DMX link termination device (by others) should be used on last fixture in line on a circuit to avoid signal loss.

D8 / DIML8 / D8E
DMX CONTROLS



USAI Lighting

www.usailighting.com
info@usailighting.com

1126 River Road
New Windsor, NY 12553

T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D15 / DIML15

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

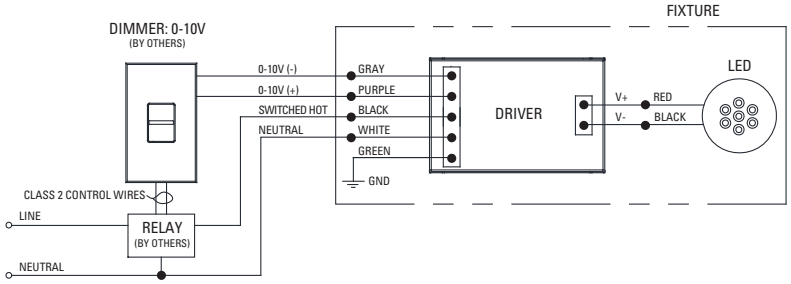
1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D15 / DIML15 LED: 0-10V, 347V Dimming Driver Wiring (Dims down to 1%) 347V Only

D15 / DIML15 Dimmer Compatibility Chart			
Manufacturer	Product	Dimmed Light Output Range	Qty Fixtures Per Dimmer*
347			Use source current per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
Acuity	Synergy ISD-BC	100% - 1%	
Douglas Lighting	WPN-5721, WPN-5822	100% - 1%	
Hubbell	Light Hawk2 LHD-IRS3-N347-xx	100% - 1%	
Leviton	Illumatech IP710-DLZ with 347V relay	100% - 1%	
Leviton	Centura Fluorescent Control System	100% - 1%	
Lutron	Nova NFTV-* dimmer plus 347V relay	100% - 1%	
Lutron	Diva DVTV-* dimmer plus 347V relay	100% - 1%	

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

D15 / DIML15
0-10V DIMMING W/RELAY TO SWITCH POWER



NOTE:
If switched, non-dimming operation is desired, cap off purple and gray wires individually at installation. Do NOT cap purple and gray wires together.

www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D18

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D18 Dimming Driver Wiring

D18 are programmed dimming drivers.
D18 Moons DMX control dims from 100% to 1%

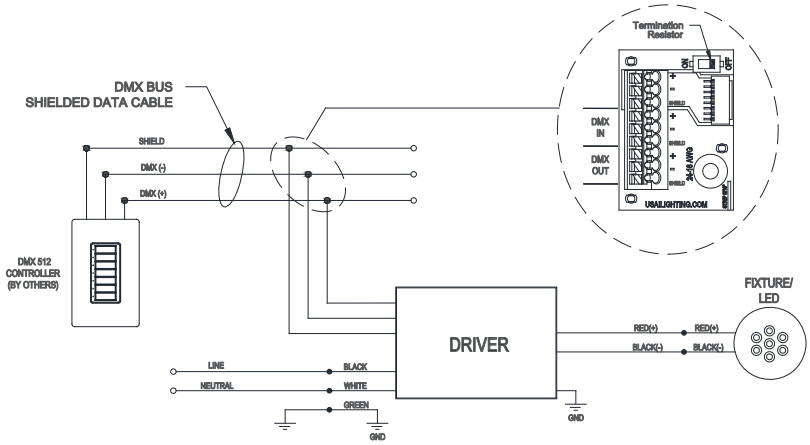
DMX BUS -
SHIELDED DATA CABLE

The data cable used must meet the following requirements:

- type: shielded, 2-conductor twisted pair
- maximum capacitance between conductors: 30 pF/ft
- maximum capacitance between conductor and shield: 55 pF/ft
- maximum resistance: 0.02 ohms/ft
- normal impedance: 100-140 ohms
- conductive core: 24 AWG is recommended

If 3-wire data cables are preferred, we suggest a Belden 9841 or equivalent cable which meets the specifications for EIA RS-485 applications. Do not use standard microphone cables: they cannot transmit DMX512 data reliably over long distances. NOTE: DMX link termination device, provided through Dip Switch on connection board, should be used on last fixture in line on a circuit to avoid signal loss.

D18
DMX CONTROLS



USAI Lighting

www.usailighting.com
info@usailighting.com

1126 River Road
New Windsor, NY 12553

T 845–565–8500
F 845–561–1130

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BeveLED Mini® Complete - B3RW
3″ Round Wall Wash

USAI® Lighting

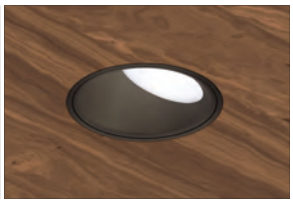
Universal and Field Convertible - Trim | Trimless | Millwork

Trimmed - B3RWF

usailighting.com/beveledmini

Trimless - B3RWL

Millwork - B3RWM



Trimless Acoustical Tile - B3RWP

To specify Trimless Acoustical Lighting visit usailighting.com/B3RWP

Introducing new and improved BeveLED Mini, the smallest member of of our iconic BeveLED family. BeveLED Mini has been infused with upgraded performance for superior light in every application. Now available with the following features, by popular demand:

FEATURES

- Upgraded performance and more LED color options than ever before!
- Field Flexibility - it's now easy to change trim in the field between trimmed, trimless and millwork
- Dry/damp/wet location rated for bathrooms and showers, including trimless and millwork
- More dimming options and all color technologies available
- Clear overspray protector for installation convenience
- Full family platform
- Iconic beveled look

WALL WASH PERFORMANCE DATA

LED COLOR CHOICES

DELIVERED* PERFORMANCE:	Classic White			Warm Glow Dimming		Color Select	
	9W	15W	20W	15W	20W	12W	18W
Source Lumens:	1175	1825	2475	1350	1800	925	1200
Lumens Per Watt:	69	69	67	52	51	46	41
Delivered Lumens:	625	975	1325	775	1050	550	750

*Based on 3000K, 80+ CRI. Performance varies for each specific beamspread and color temperature. See IES files for exact values at usailighting.com.

CORRELATED COLOR TEMPERATURE MULTIPLIER	Classic White											
	2700K			3000K			3500K			4000K		
Color Rendering Index:	80+	90+	95+	80+	90+	95+	80+	90+	95+	80+	90+	95+
Multiplier for Lumen	0.96	0.81	0.70	1.00	0.86	0.74	1.03	0.88	0.79	1.06	0.81	0.81

	Warm Glow Dimming					Color Select						
	2700K		3000K		3500K	2200K	2700K	3000K	3500K	4000K	5000K	6000K
Color Rendering Index:	80+	90+	80+	90+	80+	80+	80+	80+	80+	80+	80+	80+
Multiplier for Lumen	1.00	0.78	1.00	0.83	1.05	0.92	0.97	1.00	1.03	1.05	1.10	1.13

USAI LIGHTING COLLABORATORY
13 Crosby Street
New York, NY 10013
845-234-4090
showroom@usailighting.com

USAI LIGHTING HEADQUARTERS
1126 River Road
New Windsor, NY 12553
T: 845–565–8500 F: 845–561–1130
info@usailighting.com

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BeveLED Mini® Complete - B3RW
3″ Round Wall Wash with Integral Driver Housings

USAI® Lighting

Specify fixture part number. (All boxes must be filled in to correctly order)

B3RW__			W2-D1						
BeveLED Trim Style	**Wattage Options**	**LED Color Options**	**Beam Options**	**Bevel Trim Finish Options**	***Flange/ Millwork Collar Finish**	**Housing Options**	**Voltage Options** *Select one*	**Dimming Driver Options**	**Acessories (Optional)***
F Trimmed with Flange (use with all materials) **L** Trimless Spackle-in (use with sheetrock and plaster only) **M** Millwork Knife-Edge (use with wood and stone)	**Classic White Light** **09X3** 9W LED **15X3** 15W LED **20X3** 20W LED	**27KS** 2700K, 80+ CRI **27KH** 2700K, 90+ CRI **27KU** 2700K, 95+ CRI **30KS** 3000K, 80+ CRI **30KH** 3000K, 90+ CRI **30KU** 3000K, 95+ CRI **35KS** 3500K, 80+ CRI **35KH** 3500K, 90+ CRI **35KU** 3500K, 95+ CRI **40KS** 4000K, 80+ CRI **40KH** 4000K, 90+ CRI **40KU** 4000K, 95+ CRI	**W2-D1** Horizontal Wall Wash Optic	**WH** White **SC** Conduit Silver **GR** Grey **BL** Black **BZ** Bronze **PR** Primer Finish **AC** Clear Matte Anodized **AB** Piano Gloss Black **RAL** Custom Color Specify RAL #	**WH** White **SC** Conduit Silver **GR** Grey **BL** Black **BZ** Bronze **PR** Primer Finish **AC** Clear Matte Anodized **WH** White **BL** Black **GR** Grey **BZ** Bronze **AB** Piano Gloss Black **WH** White **GR** Grey **BL** Black **BZ** Bronze **RAL** Custom Color Specify RAL # *Leave blank for Trimless	**FT** Flat Housing New Construction (1, 2) **FTIC** Flat Housing IC-Rated (up to 15W maximum) (1, 2) **FTA** Flat Adjustable Housing **NC1** New Construction All-in-One **NCCP** Chicago Plenum **NCIC** Insulation Contact Rated / Airtight	**UNV** 120V-277V	***For use with Universal Voltage 120V - 277V*** *No Additional Charge* **D22** ERP 0-10V, 1% (2) **D6E** EldoLED 0-10V, 1% (4) **D6F** EldoLED 0-10V, 1% (4) **D4A** Lutron ECO, 0.1% (1, 2, 4) **D4E** Lutron 5 ECO, 5% (1, 2, 3, 4) **D4H** Lutron H ECO, 1% Fade (1, 2, 3, 4) **D4P** Lutron ECO, 1% (4) **D6A** EldoLED 0-10V, 0.1% (4) **D6B** EldoLED 0-10V, 0.1% (4) **D7** EldoLED DALI, 0.1% (4) **D18** Moons' DMX, 0.1% (2, 3, 4, 8)	**CB27** 27" C-Channel Bars **CB32** 32" C-Channel Bars **CB52** 52" C-Channel Bars **CM27** 27" C-Channel Bars (use with FT or FTIC housings only) **CM52** 52" C-Channel Bars (use with FT or FTIC housings only) **EM** Emergency Battery (7) **EMW** Emergency Battery Wet Location (7) * Residential grade nailer bars provided standard
	Warm Glow Dimming **15WG2** 15W LED **20WG2** 20W LED	**2722KS** 2700K-2200K, 80+ CRI **2722KH** 2700K-2200K, 90+ CRI **3022KS** 3000K-2200K, 80+ CRI **3022KH** 3000K-2200K, 90+ CRI **3522KS** 3500K-2200K, 80+ CRI					**120V**	***For use with 120V only*** *No Additional Charge* **D19** Phase 2-wire, 1% (1, 2) **D22** ERP Phase 2-wire, 1% (2) **D3** Lutron 2-wire, 1% (4, 6)	
	Color Select Tunable White **12CS1** 12W LED **18CS1** 18W LED (5)	**6022KS** 6000K-2200K, Tunable White Light 80+ CRI					**347V**	***For use with 347V only*** **D15** 0-10V dim, 1% 347V only (1, 2, 3, 4)	

Notes:
1 Not available for Warm Glow.
2 Not available for Color Select
3 Not available with 9W
4 Not available with FT or FTIC housing
5 Not available with NCIC housing
6 Use only up to 15W max with NCIC housing
7 Not available with 347V. NC1 housing only. Requires above ceiling access for service
8 Not available in trimless and millwork

TRIM FINISH OPTIONS


White


Grey


Black


Bronze


Custom RAL (example)


Custom RAL (example)

Custom colors and primer finish also available

USAI LIGHTING COLLABORATORY
13 Crosby Street
New York, NY 10013
845-234-4090
showroom@usailighting.com

USAI LIGHTING HEADQUARTERS
1126 River Road
New Windsor, NY 12553
T: 845–565–8500 F: 845–561–1130
info@usailighting.com

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BeveLED Mini® Complete - B3RW
3″ Round Wall Wash with Remote Driver

USAI® Lighting

1. Specify fixture part number. (All boxes must be filled in to correctly order)

B3RW__			W2-D1				RM	
BeveLED Trim Style	**Wattage Options**	**LED Color Options**	**Beam Options**	**Bevel Trim Finish Options**	***Flange/ Millwork Collar Finish**	**Housing Options**	**Remote Dimming Driver**	**Acessories (Optional)***
F Trimmed with Flange (use with all materials) **L** Trimless Spackle-in (use with sheetrock and plaster only) **M** Millwork Knife-Edge (use with wood and stone)	**Classic White Light** **09X3** 9W LED **15X3** 15W LED **20X3** 20W LED	**27KS** 2700K, 80+ CRI **27KH** 2700K, 90+ CRI **27KU** 2700K, 95+ CRI **30KS** 3000K, 80+ CRI **30KH** 3000K, 90+ CRI **30KU** 3000K, 95+ CRI **35KS** 3500K, 80+ CRI **35KH** 3500K, 90+ CRI **35KU** 3500K, 95+ CRI **40KS** 4000K, 80+ CRI **40KH** 4000K, 90+ CRI **40KU** 4000K, 95+ CRI	**W2-D1** Horizontal Wall Wash Optic	**WH** White **SC** Conduit Silver **GR** Grey **BL** Black **BZ** Bronze **PR** Primer Finish **AC** Clear Matte Anodized **AB** Piano Gloss Black **RAL** Custom Color Specify RAL #	**WH** White **SC** Conduit Silver **GR** Grey **BL** Black **BZ** Bronze **PR** Primer Finish **AC** Clear Matte Anodized **WH** White **BL** Black **GR** Grey **BZ** Bronze **AB** Piano Gloss Black **WH** White **GR** Grey **BL** Black **BZ** Bronze **RAL** Custom Color Specify RAL # *Leave blank for Trimless	**FT** Flat Housing New Construction **FTIC** Flat Housing IC-Rated (up to 15W maximum) **FTA** Flat Adjustable Housing **NC1** New Construction All-in-One **NCCP** Chicago Plenum **NCIC** Insulation Contact Rated / Airtight	**RM** Remote Dimming Driver, specify remote power supply in table below	**CB27** 27" C-Channel Bars **CB32** 32" C-Channel Bars **CB52** 52" C-Channel Bars **CM27** 27" C-Channel Bars (use with FT or FTIC housing only) **CM52** 52" C-Channel Bars (use with FT or FTIC housing only) * Residential grade nailer bars provided standard
	Warm Glow Dimming **15WG2** 15W LED **20WG2** 20W LED	**2722KS** 2700K-2200K, 80+ CRI **2722KH** 2700K-2200K, 90+ CRI **3022KS** 3000K-2200K, 80+ CRI **3022KH** 3000K-2200K, 90+ CRI **3522KS** 3500K-2200K, 80+ CRI						

USAI Power Supply Must Be Specified

2. Specify Remote Power Supply

RPB-01				
Remote Power Supply	**Wattage Options**	**Voltage**	**Remote Dimming Type and Level**	**Remote Emergency Option**
RPB-01 BeveLED Mini Remote Power Supply	**Classic White** **09X3** 9W LED **15X3** 15W LED **20X3** 20W LED **Warm Glow** **15WG2** 15W LED **20WG2** 20W LED	**UNV** 120V - 277V	**D4A** Lutron ECO, 0.1% (1) **D4E** Lutron 5 ECO, 5% (1, 2) **D4H** Lutron H ECO, 1% Fade (1, 2) **D4P** Lutron ECO, 1% **D6A** EldoLED 0-10V, 0.1% **D6B** EldoLED 0-10V, 0.1% **D6E** EldoLED 0-10V, 1% **D6F** EldoLED 0-10V, 1% **D7** EldoLED DALI, 0.1% **D18** Moons DMX, 0.1% (2)	**EM7** EM battery requires remote enclosure by others, minimum size 14.5" L x 6.5" W x 3" H
		120V 120V Only	**D3** Lutron 2-wire, 1% **D19** Hatch Phase 2-wire, 1% (1) *1 Not available for Warm Glow 2 Not available for 9W*	

NOTE:
Remote Power Supplies Require Enclosures by Others.
See Page 6 for Details.

USAI LIGHTING COLLABORATORY
13 Crosby Street
New York, NY 10013
845-234-4090
showroom@usailighting.com

USAI LIGHTING HEADQUARTERS
1126 River Road
New Windsor, NY 12553
T: 845–565–8500 F: 845–561–1130
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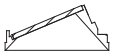
BeveLED Mini® Complete - B3RW
3″ Round Wall Wash

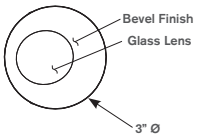
USAI® Lighting

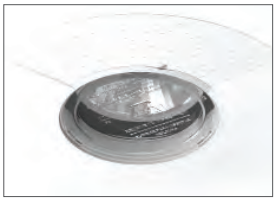
Trimless - B3RWL

TRIM DETAILS

Trimless - B3RWL



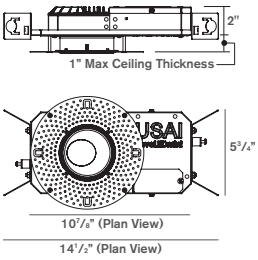




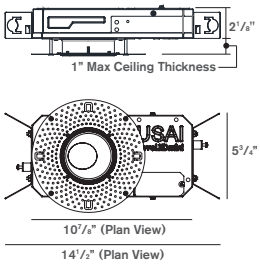
Clear acrylic overspray protector provided standard with every housing to keep out dust and contaminants during construction. Allows for use as work light.

HOUSING OPTIONS

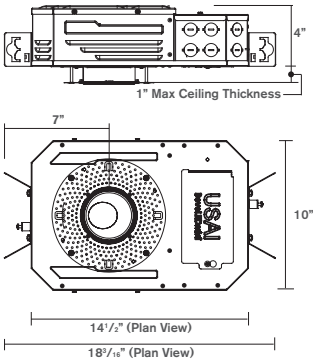
Flat Housing - FT



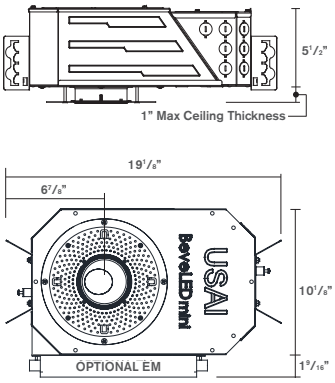
Flat Housing, IC-Rated - FTIC (up to 15W maximum)



Flat Adjustable Housing - FTA



New Construction Housing - NC1
Insulation-Contact Rated - NCIC
Chicago Plenum Rated - NCCP



USAI LIGHTING COLLABORATORY
13 Crosby Street
New York, NY 10013
845-234-4090
showroom@usailighting.com

USAI LIGHTING HEADQUARTERS
1126 River Road
New Windsor, NY 12553
T: 845–565–8500 F: 845–561–1130
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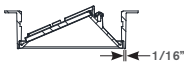
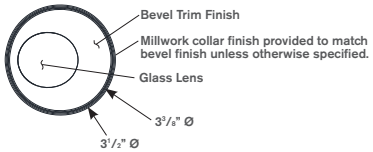
USAI Lighting

Millwork - B3RWM

TRIM DETAILS

Millwork - B3RWM

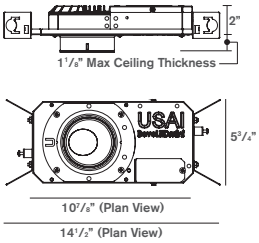




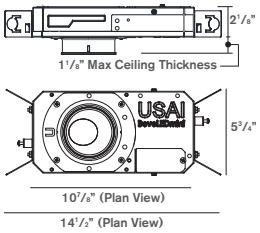
Clear acrylic overspray protector provided standard with every housing to keep out dust and contaminants during construction. Allows for use as work light.

HOUSING OPTIONS

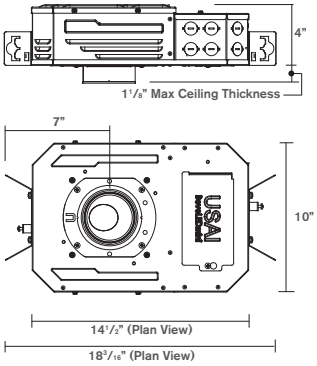
Flat Housing - FT



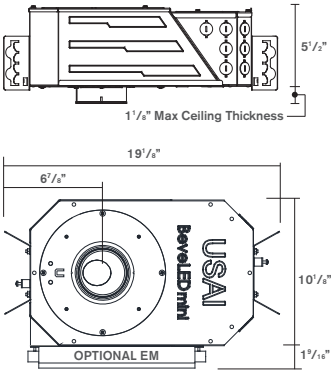
Flat Housing, IC-Rated - FTIC
(up to 15W maximum)



Flat Adjustable Housing - FTA



New Construction Housing - NC1
Insulation-Contact Rated - NCIC
Chicago Plenum Rated - NCCP



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13 Crosby Street
New York, NY 10013
845-234-4090
showroom@usailighting.com

USAI LIGHTING HEADQUARTERS
1126 River Road
New Windsor, NY 12553
T: 845–565–8500 F: 845–561–1130
info@usailighting.com

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BeveLED Mini® Complete - B3RW
3″ Round Wall Wash

USAI® Lighting

BEVELED MINI SPECIFICATIONS

FIELD REPLACEABLE LED LIGHT ENGINE
is serviceable through the aperture with a Phillips screwdriver. All USAI Lighting light engines feature industry-leading color consistency.

FIELD REPLACEABLE INTEGRAL DRIVER
Unless otherwise specified, a 0-10V, 100%-1% solid state electronic constant current integral D22 dimming driver with a high power factor is provided standard and sources 2mA. All integral dimming drivers are located within the fixture housing and are serviceable from below the ceiling through the aperture. Some on-time delay may be experienced depending on control system used. All dimming drivers comply with IEEE C62.41 surge protection.

INTEGRAL EMERGENCY BATTERY
An integral emergency battery pack is available as an option with the NC1 housing and integral driver/power supply only. IOTA emergency battery provides backup power for 90 minutes. NC1 fixtures are provided with an integral emergency battery that requires above ceiling access for service, and a remote test switch, which comes with a 24" lead length for location of the test switch. Remote EM test switch is dry/damp only; select EMW emergency option for a wet location-rated EM test switch. Fixtures that have no USAI EM option may be connected to an inverter (by others) for emergency lighting. Battery is not available with 347V.

Remote Emergency Test Switch included with NC1 housing and integral driver only. Above ceiling access required for service.

REMOTE LOCATION DRIVER
BeveLED Mini is available for use with remotely located driver. Driver is provided separately for remote location on site, enclosure to be provided by others. Remote dimming driver power supply option must be clearly specified in the "RP" table. Remote power supplies require enclosures by others that meet local codes and must be located in an accessible service panel within 100ft of the light fixture; see remote driver table below for coordination of enclosure sizes and wire gauges required. All dimming drivers comply with IEEE C62.41 surge protection.

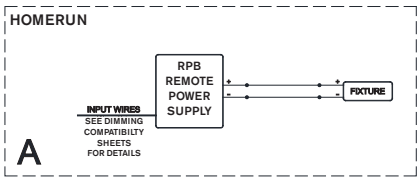
Remote Power Supply Requirements and Wiring Diagram
enclosure sizes and wire gauge with **1 fixture** per power supply.

Remote Power Supply Dimming Option			Wire Gauge Required*	Minimum Enclosure Size Required (by others) RP Only	RP with EM Option**
RPB-01-09X3 RPB-01-15X3 RPB-01-20X3 RPB-01-15WG2 RPB-01-20WG2	**UNV-D4A**	Lutron ECO, 0.1% (1)	14/12	6.25" W x 4" L x 2" H	14.5" W x 6.5" L x 3" H
	UNV-D4E	Lutron 5 ECO, 5% (1, 2)			
	UNV-D4H	Lutron H ECO, 1% fade (1, 2)			
	UNV-D4P	Lutron ECO, 1%			
	UNV-D6A	EldoLED 0-10V, 0.1%	18/16		
	UNV-D6B	EldoLED 0-10V, 0.1%			
	UNV-D6E	EldoLED 0-10V, 1%			
	UNV-D6F	EldoLED 0-10V, 1%			
	UNV-D7	EldoLED DALI, 0.1%			
	UNV-D18	Moons DMX, 0.1% (2)			
	120V-D3	Lutron 2-wire phase, 1%	14/12	5.75" W X 2.625" L x 2" H	
	120V-D19	Hatch 2-wire phase, 1% (1)	14/12		

1 Not available for Warm Glow
2 Not available for 9W

Not all dimming options are availbale with all LED light engine options. See RP ordering table for details.
* Wire gauge 14/12 = Maximum distance from light fixture to remote power supply is 100' using 12 gauge wire, 50' using 14 gauge wire.
* Wire gauge 18/16 = Maximum distance from light fixture to remote power supply is 100' using 16 gauge wire, 50' using 18 gauge wire.
** Emergency battery remote power supplies cannot be located any more than 50 feet from light fixture.

Note: All light fixtures must be wired in homeruns per wiring diagram below.



USAI LIGHTING COLLABORATORY
13 Crosby Street
New York, NY 10013
845-234-4090
showroom@usailighting.com

USAI LIGHTING HEADQUARTERS
1126 River Road
New Windsor, NY 12553
T: 845–565–8500 F: 845–561–1130
info@usailighting.com

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BeveLED Mini® Complete - B3RW
3″ Round Wall Wash

USAI® Lighting

BEVELED MINI SPECIFICATIONS

ADJUSTMENT
362° horizontal locking in 90° increments.

HOUSING
All BeveLED Mini fixtures are field-flexible which allows for field changes from trimless or millwork to trimmed with a simple components change with parts from USAI. Housings are fabricated of 20 ga. steel construction with thru wire J-box, 4 in 4 out at min. 90°C, #12 AWG thru branch circuit wiring. FTIC and NCIC housing for use with 9W, 12W and 15W light engines only are rated for direct contact with spray foam insulation of R-42 or less. FTIC housing is IC-rated up to 15W maximum.

MOUNTING
B3RWF overlap flange fixtures are designed for use in sheetrock, acoustical ceiling tile, and many other ceiling materials. B3RWL trimless fixtures are provided with a spackle collar and are designed for use in sheetrock/mud-in ceiling applications. B3RWM millwork fixtures are provided with a millwork collar and are designed for use in wood/millwork and stone construction applications. Butterfly brackets and residential grade adjustable nailer bars extendible from 14" to 24" centers with integral nails are provided standard for attachment to building structure. C-channel bars are optionally available for acoustical ceiling applications. If channel bars are specified for FT or FTIC housing, special reduced height channel bars (CM27 or CM52) will be provided.

Residential-grade nailer bars provided standard.

FIXTURE WEIGHT
FT and FTIC housings weigh 4 lbs. FTA housing weighs 10lbs. NC1, NCIC, and NCCP housings weigh 11 lbs. NC1 housing with EM weighs 14 lbs.

WARRANTY
Based on IESNA LM80-2008, BeveLED has a 50,000 hour rated life at 70% lumen maintenance (L70). USAI Lighting Warranty covers replacement parts for 5 years from date of shipment. Ambient temperatures at fixture location should not exceed 40°C during normal operation.

CEILING CUT OUT
B3RWF Trimmed with Overlap Flange: 3-5/8"Ø
B3RWL Trimless Spackle-in: 4-3/16"Ø
B3RWM Millwork Knife-edge: 3-9/16"Ø

LISTINGS
Dry/Damp/Wet location. AC and AB trim finishes are dry/damp only. EM test switch is dry/damp only. Select EMW option for wet location remote test switch. UL2043 rated for use in air handling plenums. NRTL/CSA-US tested to UL standards. IBEW union made.

NOTES
- Not for use in corrosive environment
- Use of pressure washer voids warranty

PHOTOMETRICS
Consult factory or website for IES files. Tested in accordance with IESNA LM79.

USAI LIGHTING COLLABORATORY
13 Crosby Street
New York, NY 10013
845-234-4090
showroom@usailighting.com

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1126 River Road
New Windsor, NY 12553
T: 845–565–8500 F: 845–561–1130
info@usailighting.com

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Cut sheet 7 of 9

BeveLED Mini® Complete - B3RW
3″ Round Wall Wash

USAI® Lighting

BEVELED MINI SPECIFICATIONS

ADJUSTMENT
362° horizontal locking in 90° increments.

HOUSING
All BeveLED Mini fixtures are field-flexible which allows for field changes from trimless or millwork to trimmed with a simple components change with parts from USAI. Housings are fabricated of 20 ga. steel construction with thru wire J-box, 4 in 4 out at min. 90°C, #12 AWG thru branch circuit wiring. FTIC and NCIC housing for use with 9W, 12W and 15W light engines only are rated for direct contact with spray foam insulation of R-42 or less. FTIC housing is IC-rated up to 15W maximum.

MOUNTING
B3RWF overlap flange fixtures are designed for use in sheetrock, acoustical ceiling tile, and many other ceiling materials. B3RWL trimless fixtures are provided with a spackle collar and are designed for use in sheetrock/mud-in ceiling applications. B3RWM millwork fixtures are provided with a millwork collar and are designed for use in wood/millwork and stone construction applications. Butterfly brackets and residential grade adjustable nailer bars extendible from 14" to 24" centers with integral nails are provided standard for attachment to building structure. C-channel bars are optionally available for acoustical ceiling applications. If channel bars are specified for FT or FTIC housing, special reduced height channel bars (CM27 or CM52) will be provided.

Residential-grade nailer bars provided standard.

FIXTURE WEIGHT
FT and FTIC housings weigh 4 lbs. FTA housing weighs 10lbs. NC1, NCIC, and NCCP housings weigh 11 lbs. NC1 housing with EM weighs 14 lbs.

WARRANTY
Based on IESNA LM80-2008, BeveLED has a 50,000 hour rated life at 70% lumen maintenance (L70). USAI Lighting Warranty covers replacement parts for 5 years from date of shipment. Ambient temperatures at fixture location should not exceed 40°C during normal operation.

CEILING CUT OUT
B3RWF Trimmed with Overlap Flange: 3-5/8"Ø
B3RWL Trimless Spackle-in: 4-3/16"Ø
B3RWM Millwork Knife-edge: 3-9/16"Ø

LISTINGS
Dry/Damp/Wet location. AC and AB trim finishes are dry/damp only. EM test switch is dry/damp only. Select EMW option for wet location remote test switch. UL2043 rated for use in air handling plenums. NRTL/CSA-US tested to UL standards. IBEW union made.

NOTES
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13 Crosby Street
New York, NY 10013
845-234-4090
showroom@usailighting.com

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1126 River Road
New Windsor, NY 12553
T: 845–565–8500 F: 845–561–1130
info@usailighting.com

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USAI® Lighting

LED COLOR OPTIONS

Classic White Light

Our proprietary LED light engines achieve a 2-step MacAdam ellipse along the black body locus, resulting in reliable and uniform color from fixture to fixture. You'll see the results in consistently beautiful light throughout your space, whichever USAI LED product you specify.

Warm Glow® Dimming

Warm Glow Dimming provides warmth and glow once possible only in dimmed incandescent sources. Utilizing our patented proprietary algorithm and circuitry, Warm Glow Dimming technologies precisely mimic the black body curve of a standard 100W A19 lamp by gradually transitioning from 2700K , 3000K or 3500K down to 2200K. The result is virtually indistinguishable from an incandescent light source.

Color Select® Tunable White

Color Select represents the next innovation in color temperature control for advanced LED recessed downlighting. Color Select® products allow users to adjust color temperature from 6000K down to 2200K while independently adjusting intensity to achieve ultimate control over the quality of light in a space with a single fixture type. Color Select interfaces with standard dimming and control systems.

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13 Crosby Street
New York, NY 10013
845-234-4090
showroom@usailighting.com

USAI LIGHTING HEADQUARTERS
1126 River Road
New Windsor, NY 12553
T: 845–565–8500 F: 845–561–1130
info@usailighting.com

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CONFIGURABLE SPEC SHEETS COMING SOON

BeveLED® 2.2 Incline - B4RG
4.5″ Round Downlight for Sloped Ceilings

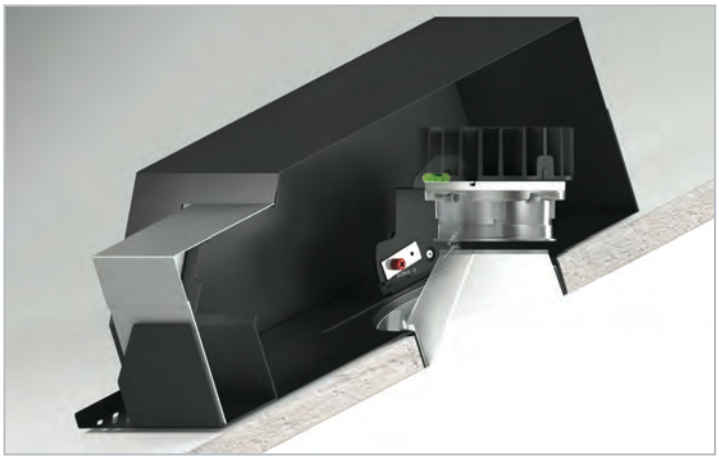
USAI® Lighting

Field Convertible from Trimless or Millwork to Trimmed

Trimmed - B4RGF

Trimless - B4RGL

Millwork - B4RGM



usailighting.com/slopedceiling

Introducing Beautiful, Precise Recessed Lighting for Sloped Ceiling Installations Up to 45 Degrees.

FEATURES

- Solutions for angles from 15° (3/12 pitch) to 45° (12/12 pitch)
- Perfect round and square roomside appearance
- Installations are always aligned with integral leveler
- Works with sheetrock, stone, plaster, and millwork ceilings
- Easily change from trimless or millwork to trimmed in the field
- Rated for direct contact with spray-foam insulation

SLOPED DOWNLIGHT PERFORMANCE DATA

DELIVERED* PERFORMANCE:	LED COLOR CHOICES									
	Classic White						Warm Glow Dimming		Color Select	
	9W	12W	16W	24W	33W	36W	16W	32W	16W	32W
Source Lumens:	1150	1300	1725	2400	3025	4150	1275	2150	1250	2075
Lumens Per Watt:	88	75	75	69	60	85	61	51	58	52
Delivered Lumens:	800	900	1200	1650	2075	2975	975	1625	925	1650

*Based on 3000K, 80+ CRI. Performance varies for each specific beamspread and color temperature. See IES files for exact values at usailighting.com.

CORRELATED COLOR TEMPERATURE MULTIPLIER	Classic White								Warm Glow Dimming				Color Select					
	2700K		3000K		3500K		4000K		2700K		3000K		2200K	2700K	3500K	4000K	5000K	6000K
Color Rendering Index:	80+	90+	80+	90+	80+	90+	80+	90+	80+	90+	80+	90+	80+	80+	80+	80+	80+	80+
Multiplier for Lumen Output:	0.94	0.78	1.00	0.78	1.00	1.00	1.06	1.06	0.94	0.74	1.00	0.80	0.87	0.96	1.04	1.09	1.13	1.18

USAI LIGHTING COLLABORATORY
13 Crosby Street
New York, NY 10013
845–234–4090
showroom@usailighting.com

USAI LIGHTING HEADQUARTERS
1126 River Road
New Windsor, NY 12553
T: 845–565–8500
info@usailighting.com

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BeveLED® 2.2 Incline - B4RG
4.5″ Round Downlight for Sloped Ceilings

USAI® Lighting

Specify fixture part number. (All boxes must be filled in to correctly order)

B4RG__

BeveLED Trim Style

F Trimmed with Flange

L Trimless Spackle-in

M Millwork Knife-edge

Ceiling Slope

30 Angled trim accomodates ceiling slopes from 15° (3/12 pitch) to 30° (7/12 pitch) maximum

45 Angled trim accomodates ceiling slopes from 30° (7/12 pitch) to 45° (12/12 pitch) maximum

Wattage Options / LED Color Options / Beam Options

Classic White Light

Wattage Options	LED Color Options	Beam Options
09C3 9W LED	**27KS** 2700K, 80+ CRI	**25** 25° beam
12C3 12W LED	**27KH** 2700K, 90+ CRI	**40** 40° beam
16C3 16W LED	**30KS** 3000K, 80+ CRI	**70** 70° beam
24C3 24W LED	**30KH** 3000K, 90+ CRI	
33C3 33W LED (7)	**35KS** 3500K, 80+ CRI	
36E1 36W LED (7)	**35KH** 3500K, 90+ CRI	
	40KS 4000K, 80+ CRI	
	40KH 4000K, 90+ CRI	

Warm Glow Dimming

Wattage Options	LED Color Options	Beam Options
16WG2 16W LED	**2722KS** 2700K-2200K, 80+ CRI	**25** 25° beam
32WG2 32W LED (7)	**2722KH** 2700K-2200K, 90+ CRI	**40** 40° beam
	3022KS 3000K-2200K, 80+ CRI	**65** 65° beam
	3022KH 3000K-2200K, 90+ CRI	

Color Select Tunable White

Wattage Options	LED Color Options	Beam Options
16CS1 16W LED	**6022KS** 6000K-2200K, Tunable White Light 80+ CRI	**30** 30° beam
32CS1 32W LED (7)		**40** 40° beam
		50 50° beam

Lens Options

S Solite (provided standard)

SF Solite Frosted

BF Borosilicate Frosted

Bevel Trim Finish Options / *Flange/ Millwork Collar Finish

Bevel Trim Finish Options	*Flange/ Millwork Collar Finish
WH White	**WH** White
SC Conduit Silver	**SC** Conduit Silver
GR Grey	**GR** Grey
BL Black	**BL** Black
BZ Bronze	**BZ** Bronze
PR Primer Finish	**PR** Primer Finish
RAL Custom Color Specify RAL#	**RAL** Custom Color Specify RAL#

* Leave blank for trimless

Housing Options

NC New Construction

NCCP Chicago Plenum

NCIC Insulation Contact Rated / Airtight (24W Maximum) (1, 5)

Voltage Options
Select one

UNV 120V-277V

For use with Universal Voltage 120V - 277V

No Additional Charge

D6E EldoLED 0-10V, 1% (provided standard)

D6F EldoLED 0-10V, 1%

D4A Lutron ECO, 0.1% (1, 2, 3, 5, 6)

D4H Lutron H ECO, 1% Fade (2, 3, 4)

D4P Lutron ECO, 1% (1, 5, 6)

D6A EldoLED 0-10V, 0.1%

D6B EldoLED 0-10V, 0.1%

D7 EldoLED DALI, 0.1%

D28 EldoLED DMX, 0.1%

120V

For use with 120V only

No Additional Charge

D19 Phase 2-wire, 1% (1, 2, 3, 4, 5)

D3 Lutron 2-wire, 1%

347V

For use with 347V only

D15 0-10V dim, 1% 347V only (2, 3)

Dimming Driver Options

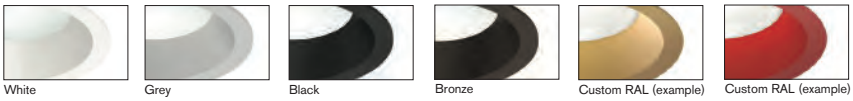
Accessories (Optional)*

EM Emergency Battery (8)

EMW Emergency Battery Wet Location (8)

Notes:
1 Not available with 36E1LED
2 Not available for Warm Glow
3 Not available for Color Select
4 Not available with 9W
5 Not available with 33W
6 For use with 16W and lower only
7 Not available with NCIC housing
8 Not available with 347V. For NC housings only

TRIM FINISH OPTIONS



White | Grey | Black | Bronze | Custom RAL (example) | Custom RAL (example)

Custom colors and primer finish also available

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showroom@usailighting.com

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New Windsor, NY 12553
T: 845–565–8500
info@usailighting.com

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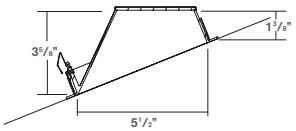
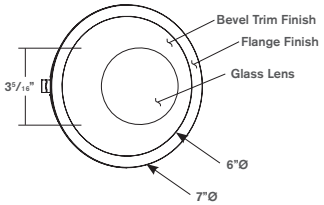
USAI® Lighting

Trimmed - B4RGF

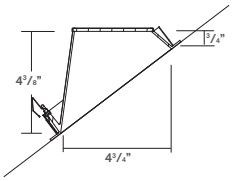
TRIM DETAILS

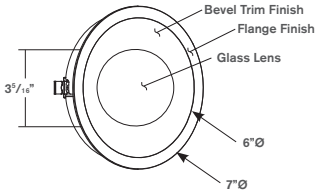
For 15° (3/12) - 30° (7/12) Slope Ceilings





For 30° (7/12) - 45° (12/12) Slope Ceilings

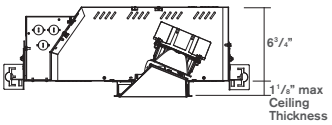


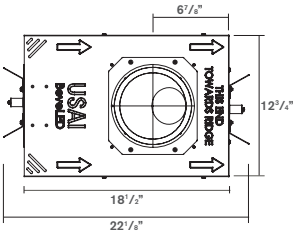


HOUSING OPTIONS

For 15° (3/12) - 30° (7/12) Slope Ceilings

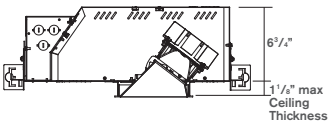
New Construction - NC
Chicago Plenum - NCCP
Insulated Contact Rated / Airtight - NCIC

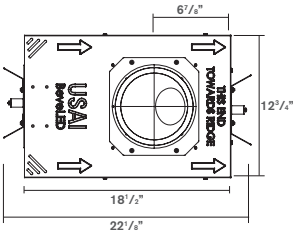




For 30° (7/12) - 45° (12/12) Slope Ceilings

New Construction - NC
Chicago Plenum - NCCP
Insulated Contact Rated / Airtight - NCIC





USAI LIGHTING COLLABORATORY
13 Crosby Street
New York, NY 10013
845-234-4090
showroom@usailighting.com

USAI LIGHTING HEADQUARTERS
1126 River Road
New Windsor, NY 12553
T: 845-565-8500
info@usailighting.com

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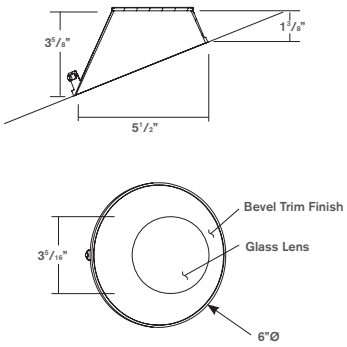
USAI® Lighting

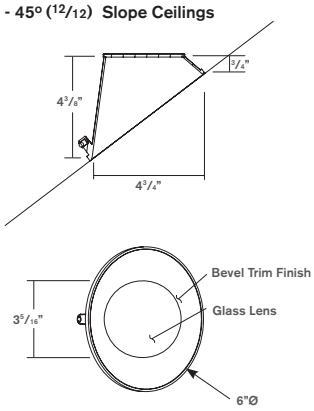
Trimless - B4RGL

TRIM DETAILS

For 15° (3/12) - 30° (7/12) Slope Ceilings



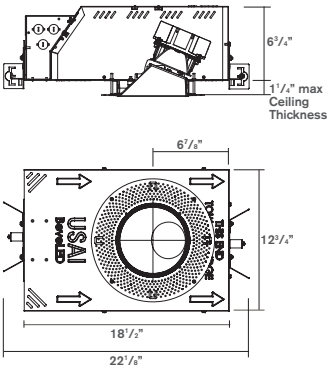
For 30° (7/12) - 45° (12/12) Slope Ceilings



HOUSING OPTIONS

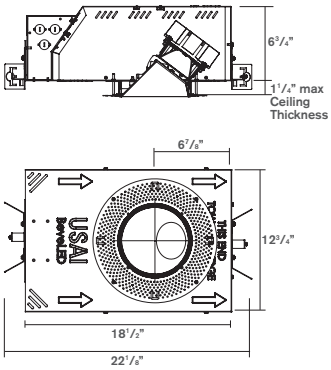
For 15° (3/12) - 30° (7/12) Slope Ceilings

New Construction - NC
Chicago Plenum - NCCP
Insulated Contact Rated / Airtight - NCIC



For 30° (7/12) - 45° (12/12) Slope Ceilings

New Construction - NC
Chicago Plenum - NCCP
Insulated Contact Rated / Airtight - NCIC



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13 Crosby Street
New York, NY 10013
845–234–4090
showroom@usailighting.com

USAI LIGHTING HEADQUARTERS
1126 River Road
New Windsor, NY 12553
T: 845–565–8500
info@usailighting.com

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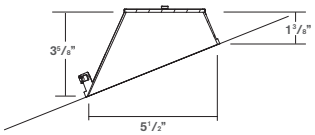
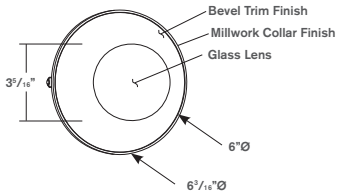
Millwork - B4RGM

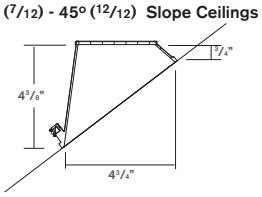
TRIM DETAILS

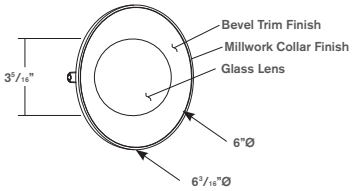
For 15º (3/12) - 30º (7/12) Slope Ceilings





For 30º (7/12) - 45º (12/12) Slope Ceilings

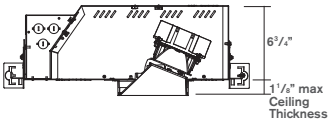


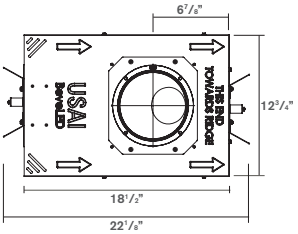


HOUSING OPTIONS

For 15º (3/12) - 30º (7/12) Slope Ceilings

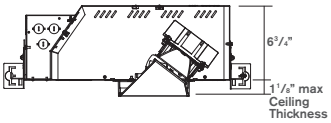
New Construction - NC
Chicago Plenum - NCCP
Insulated Contact Rated / Airtight - NCIC

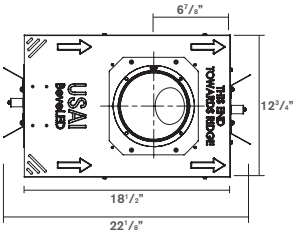




For 30º (7/12) - 45º (12/12) Slope Ceilings

New Construction - NC
Chicago Plenum - NCCP
Insulated Contact Rated / Airtight - NCIC





USAI LIGHTING COLLABORATORY
13 Crosby Street
New York, NY 10013
845–234–4090
showroom@usailighting.com

USAI LIGHTING HEADQUARTERS
1126 River Road
New Windsor, NY 12553
T: 845–565–8500
info@usailighting.com

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BeveLED® 2.2 Incline - B4RG
4.5″ Round Downlight for Sloped Ceilings

USAI® Lighting

BEVELED 2.2 INCLINE SPECIFICATIONS

FIELD REPLACEABLE LED LIGHT ENGINE
is serviceable through the aperture without tools or with a Philips screwdriver. All USAI Lighting light engines feature industry-leading color consistency.

FIELD REPLACEABLE DRIVER
Unless otherwise specified, a 0-10V, 100%-1% solid state electronic constant current integral D6E dimming driver with a high power factor is provided standard and sources 2mA. All integral dimming drivers are located within the fixture housing and are serviceable from below the ceiling through the aperture. Some on-time delay may be experienced depending on control system used. All dimming drivers comply with IEEE C62.41 surge protection.

EMERGENCY BATTERY
IOTA emergency battery provides backup power for 90 minutes. NC EM fixtures are provided with an integral emergency battery which can be serviced through the aperture from below the ceiling plane, and a remote test switch, which comes with a 24" lead length for location of the test switch. Remote EM test switch is dry/damp only; select EMW emergency option for a wet location-rated EM test switch. Fixtures that have no USAI EM option may be connected to an inverter (by others) for emergency lighting. Battery is not available with 347V.

Remote Emergency Test Switch included

ADJUSTMENT
Sloped ceiling housings are fitted with an integral bubble leveling device to ensure perfectly level installations and optical alignment. Optical assembly can be tilted and locked in position for ceiling slopes from 3/12 pitch to 12/12 pitch, which are visually indicated on tilt mechanism. Butterfly brackets are imprinted with ceiling thickness indexing allow installers to easily preset housing prior to installation: choose from ceiling thicknesses of ½", 5/8", ¾", 7/8", 1", or 1-1/8".

HOUSING
All BeveLED 2.2 fixtures are field-flexible which allows for field changes from trimless or millwork to trimmed with a simple components change with parts from USAI. Housings are fabricated of 20 ga. steel construction with thru wire J-box, 4 in 4 out at min. 90°C, #12 AWG thru branch circuit wiring. NCIC housing for use with 9W, 12W, and 16W light engines only are rated for direct contact with spray foam insulation of R-42 or less. NCIC housing is IC-rated up to 24W maximum.

MOUNTING
B4RGF overlap flange fixtures are designed for use in sheetrock, acoustical ceiling tile, and many other ceiling materials. B4RGL trimless fixtures are provided with a spackle collar and are designed for use in sheetrock/mud-in ceiling applications. B4RGM millwork fixtures are provided with a millwork collar and are designed for use in wood/millwork and stone construction applications. Butterfly brackets and adjustable channel bars extendible from 16" to 24" centers with integral nails are provided for attachment to building structure.

FIXTURE WEIGHT
NC, NCIC and NCCP housings weigh 16 lbs. NC housing with EM weighs 24.5 lbs.

WARRANTY
Based on IESNA LM80-2008, BeveLED has a 50,000 hour rated life at 70% lumen maintenance (L70). USAI Lighting Warranty covers replacement parts for 5 years from date of shipment. Ambient temperatures at fixture location should not exceed 40°C during normal operation.

CEILING CUT OUT
B4RGF Trimmed Overlap Flange: 6-5/8" Ø
B4RGL Trimless Spackle Frame: 7-1/8" Ø
B4RGM Millwork Knife Edge: 6-7/16" Ø

LISTINGS
Dry/Damp/Wet location. Remote EM test switch is dry/damp only. Select EMW option for wet location remote test switch. UL2043 rated for use in air handling plenums. NRTL/CSA-US tested to UL standards. IBEW union made.

NOTES
- Not for use in corrosive environment
- Use of pressure washer voids warranty

PHOTOMETRICS
Consult factory or website for IES files. Tested in accordance with IESNA LM79.

USAI LIGHTING COLLABORATORY
13 Crosby Street
New York, NY 10013
845–234–4090
showroom@usailighting.com

USAI LIGHTING HEADQUARTERS
1126 River Road
New Windsor, NY 12553
T: 845–565–8500
info@usailighting.com

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LED COLOR OPTIONS

Classic White Light

Our proprietary LED light engines achieve a 2-step MacAdam ellipse along the black body locus, resulting in reliable and uniform color from fixture to fixture. You'll see the results in consistently beautiful light throughout your space, whichever USAI LED product you specify.


Warm Glow® Dimming

Warm Glow Dimming provides warmth and glow once possible only in dimmed incandescent sources. Utilizing our patented proprietary algorithm and circuitry, Warm Glow Dimming technologies precisely mimic the black body curve of a standard 100W A19 lamp by gradually transitioning from 2700K or 3000K down to 2200K. The result is virtually indistinguishable from an incandescent light source.


Color Select® Tunable White

Color Select represents the next innovation in color temperature control for advanced LED recessed downlighting. Color Select® products allow users to adjust color temperature from 6000K down to 2200K while independently adjusting intensity to achieve ultimate control over the quality of light in a space with a single fixture type. Color Select interfaces with standard dimming and control systems.


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1126 River Road
New Windsor, NY 12553
T: 845–565–8500
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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D3 / DIML3

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

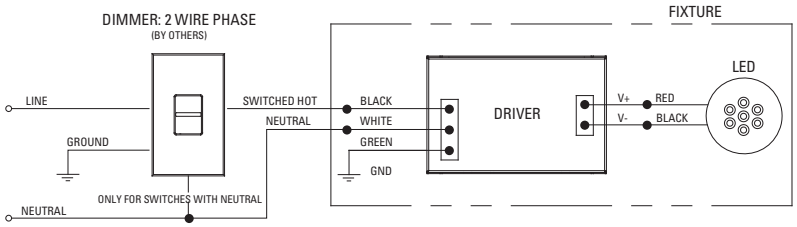
D3 / DIML3 LED: Lutron Hi-Lume A-Series 2 Wire Fwd Phase (with neutral) / LED Dimming Driver Wiring (Dims down to 1%) 120V

D3 / DIML3 Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Dimmer* Fixture Wattage	
120V Only				39W and Less	40W - 80W
ETC	Sensor+ Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
ETC	Unison DRd Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
Lutron	Maestro Wireless® 600W dimmer	MRF2-6ND-120-	100% - 1%	1 – 8	1 – 4
Lutron	Maestro Wireless® 1000W dimmer	MRF2-10ND-120-	100% - 1%	1 – 13	1 – 6
Lutron	HomeWorks® QS adaptive dimmer	HQRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 600W dimmer	HQRD-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 1000 W dimmer	HQRD-10ND-	100% - 1%	1 – 13	1 – 6
Lutron	Caseta Wireless® Pro 1000W dimmer	PD-10NXD-	100% - 1%	1 – 13	1 – 6
Lutron	Stanza® dimmer	SZ-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 adaptive dimmer	RRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 1000 W dimmer	RRD-10ND-	100% - 1%	1 – 6	1 – 3
Lutron	myRoom DIN power module	MQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® QS wallbox power module	HQRJ-WPM-6D-120-	100% - 1%	1 – 26	1 – 13
Lutron	Homeworks® DIN power module	LQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® wallbox power module	HWI-WPM-6D-120	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® QS control unit	QSGR-, QSGRJ-	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® 3000 control unit	GRX-3100-, GRX-3500-	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4U module	HW-RPM-4U-120, LP-RPM-4U-120	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4A module	HW-RPM-4A-120, LP-RPM-4A-120	100% - 1%	1 – 26	1 – 13
Lutron	GP dimming panels	Various	100% - 1%	1 – 26	1 – 13
Lutron	Ariadni CL 250W dimmer	AYCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Diva CL 250W dimmer	DVCL-253P-, DVSCCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Grafik T CL or RF CL dimmer	GT-250M-, GTJ-250M-	100%-1%	1 – 8	1 – 4
Lutron	Nova T CL 250W dimmer	NTCL-250-	100%-1%	1 – 10	1 – 5

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

D3 / DIML3
2 WIRE PHASE DIMMING



USAI Lighting

www.usailighting.com
info@usailighting.com

1126 River Road
New Windsor, NY 12553

T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D4A / DIML4A and D4P / DIML4P

DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

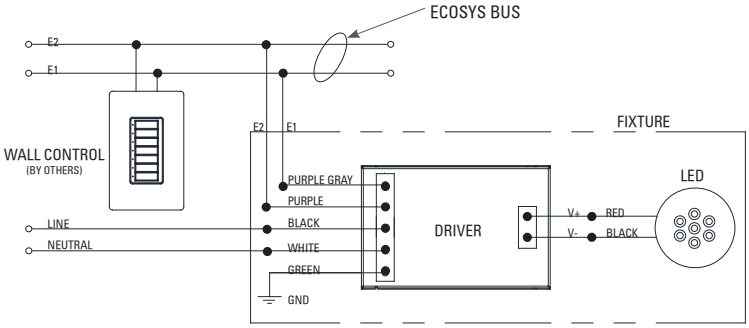
D4A / DIML4A LED: Lutron Hi-Lume Premier EcoSystem LED Driver (Dims down to 0.1%)
D4P / DIML4P LED: Lutron Hi-Lume Premier EcoSystem LED Driver (Dims down to 1%)

D4A / D4P EcoSystem Controls Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Maximum Quantity Light Fixtures Per Control
120V / 277V			
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	32
		FCJ/FCJS-ECO	3
120V ONLY			
Lutron	Energi Savr Node	QSN-1ECO-S	64
		QSN-2ECO-S	128
	GRAFIK Eye QS/ Homeworks QS control unit	QSGRJ-_ E, QSGR-_ E	64
	Quantum Hub	QP2-_ _2C	128
		QP2-_ _4C	256
		QP2-_ _6C	384
		QP2-_ _8C	512
	HomeWorks QS / myRoom Plus power module	LQSE-2ECO-D	128

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

D4A / DIML4A and D4P / DIML4P
EcoSystem CONTROLS



USAI Lighting
www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D4H /DIML4H

DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS
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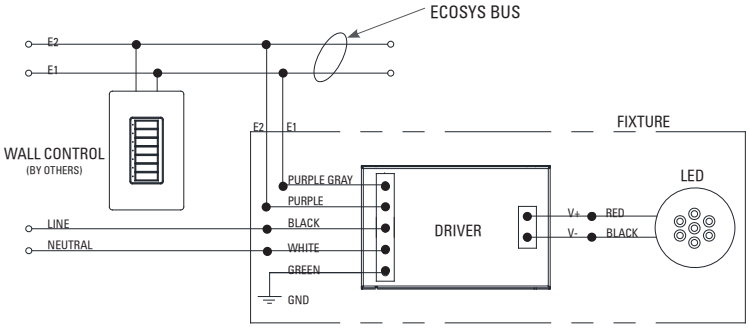
5. Cap any wires not used separately (not together).

D4H / DIML4H LED: Lutron H Series EcoSystem LED Driver with Fade to Black (dims down to 1%)

D4H / DIML4H EcoSystem Dimmer Compatibility Chart					
Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V / 277V				39W and Less	40W - 80W
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	100%–1%	1–32	1 – 16
Lutron	Energi Savr Node	QSN-1ECO-S, QSN-2ECO-S	100%–1%	1–64	1 – 32
Lutron	GRAFIK Eye QS (120V ONLY)	QSGRJ- E, QSGR- E	100%–1%	1–64	1 – 32
Lutron	Quantum	Various	100%–1%	1–64	1 – 32

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

D4H / DIML 4H
EcoSystem CONTROLS



USAI Lighting
www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D6A / DIML6A and D6E / DIML6E
D6B / DIML6B and D6F / DIML6F

IMPORTANT SAFETY INSTRUCTIONS
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5. Cap any wires not used separately (not together).

D6A / DIML6A and D6E / DIML6E LED Dimming Compatibility Table

D6A / DIML6A and D6E / DIML6E are linearly programmed dimming drivers for use with the dimming controls listed in the table below.
D6A / DIML6A = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1%
D6E / DIML6E = EldoLED ECOdrive 0-10V control dims from 100% to 1%

D6A / DIML6A and D6E / DIML6E Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range DIML6A	DIML6E	Qty Fixtures Per Dimmer*
120V & 277V					Refer to manufacturer's dimmer load rating for maximum and minimum fixture quantities per dimmer. Enlighted compatible.
Lutron	Diva	DVTV/NFTV with PP-20	99% - 0.1%	1%	
Lutron	Nova T	NTFTV with PP-20	99% - 0.1%	1%	
Lutron	Energi Savr Node	QSN-4T16-S	100% - 0.1%	1%	
Lutron	GP Dimming Panels	TVM2 Module	99% - 0.1%	1%	
Lutron	Interfaces	GRX-TVI w/ GRX3503	100% - 0.1%	1%	
Sensor Switch	nIO	nIO EZ	100% - 0.1%	1%	
enlighted	Control Unit	CU-3E-1R	100% - 0.1%	1%	

D6B / DIML6B and D6F / DIML6F LED Dimming Compatibility Table

D6B / DIML6B and D6F / DIML6F are logarithmic-programmed dimming drivers for use with the dimming controls listed in the table below.
D6B / DIML6B = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1% D6F / DIML6F = EldoLED ECOdrive 0-10V control dims from 100% to 1%

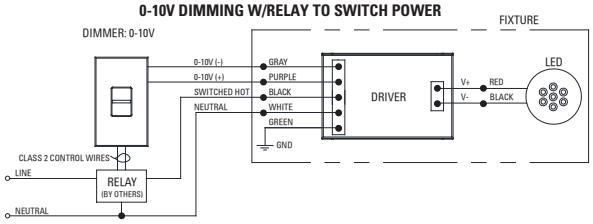
D6B / DIML6B and D6F / DIML6F Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range DIML6B	6F	Qty Fixtures Per Dimmer*
120V & 277V					Refer to manufacturer's dimmer load rating for maximum and minimum fixture quantities per dimmer. Enlighted compatible.
Bush-Jaeger	Electronic potentiometer	2112U-101	100% - 0.1%	1%	
Jung	Electronic potentiometer	240-10	100% - 0.1%	1%	
Leviton	Iluma Tech dimmer	IP710-DLX	100% - 0.1%	1%	
Lightolier (Philips)	Momentum (120V ONLY)	ZP600FAM120	100% - 0.1%	1%	
Merten	Electronic potentiometer	5729	100% - 0.1%	1%	
Pass & Seymour	Titan	CD4FB-W	100% - 0.1%	1%	
Watt Stopper	Miro	DCLV1	100% - 0.1%	1%	
Synergy	Wallbox Dimmers	ISD BC	100% - 0.1%	1%	
ABB	i-bus	SD/S 2.16.1	100% - 0.1%	1%	
Crestron	Modules	GLX-DIMFLV8, GLXP-DIMFLV8	100% - 0.1%	1%	
Crestron	Green Light	GLPAC-DIMFLV4-, GLPAC-DIMFLV8-	100% - 0.1%	1%	
Crestron	Green Light Power Pack	GLPP-DIMFLVEX-PM, GLPP-1DIMFLV2EX-PM, GLPP-1DIMFLV3EX-PM	100% - 0.1%	1%	
Crestron	DIN Rail Analog Output Module	DIN-A08	100% - 0.1%	1%	
Crestron	DIN Rail 0-10V Fluorescent Dimmer	DIN-4DIMFLV4	100% - 0.1%	1%	
Crestron	iLux 0-10V Dimmer Expansion Module	CLS-EXP-DIMFLV	100% - 0.1%	1%	
enlighted	Control Unit	CU-3E-1R	100% - 0.1%	1%	

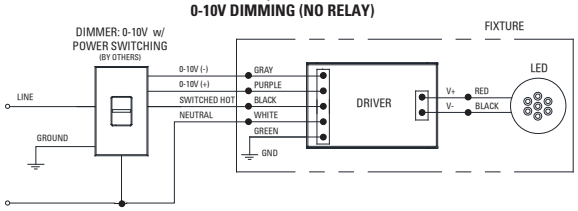
DIMMING DRIVER WIRING SCHEMES:

NOTES: Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

D6 / DIML6
0-10V DIMMING W/RELAY TO SWITCH POWER



D6 / DIML6
0-10V DIMMING (NO RELAY)



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info@usailighting.com
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New Windsor, NY 12553
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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D7 / DIML7 and D7E

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

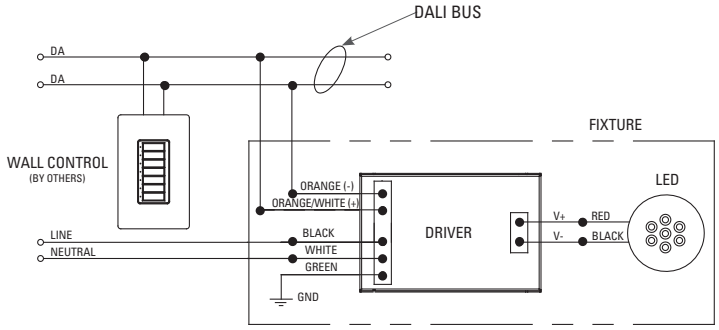
IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D7 / DIML7 and D7E Dimming Driver Wiring

D7 / DIML7 and D7E are linearly programmed dimming drivers.
D7 / DIML7 = EldoLED SOLOdrive DALI control dims from 100% to 0.1%
D7E = EldoLED ECOdrive DALI control dims from 100% to 1%

D7 / DIML7 / D7E
DALI CONTROLS



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www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D15 / DIML15

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

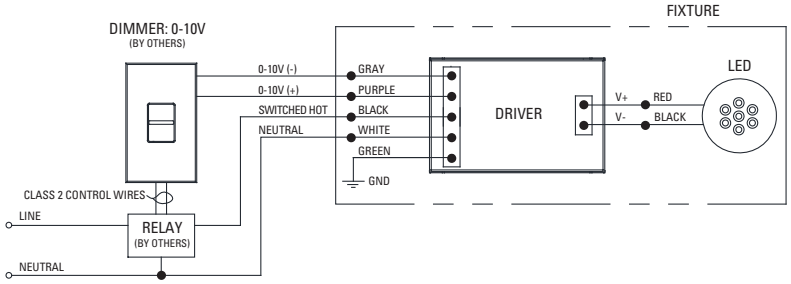
1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D15 / DIML15 LED: 0-10V, 347V Dimming Driver Wiring (Dims down to 1%) 347V Only

D15 / DIML15 Dimmer Compatibility Chart			
Manufacturer	Product	Dimmed Light Output Range	Qty Fixtures Per Dimmer*
347			Use source current per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
Acuity	Synergy ISD-BC	100% - 1%	
Douglas Lighting	WPN-5721, WPN-5822	100% - 1%	
Hubbell	Light Hawk2 LHD-IRS3-N347-xx	100% - 1%	
Leviton	Illumatech IP710-DLZ with 347V relay	100% - 1%	
Leviton	Centura Fluorescent Control System	100% - 1%	
Lutron	Nova NFTV-* dimmer plus 347V relay	100% - 1%	
Lutron	Diva DVTV-* dimmer plus 347V relay	100% - 1%	

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

D15 / DIML15
0-10V DIMMING W/RELAY TO SWITCH POWER



NOTE:
If switched, non-dimming operation is desired, cap off purple and gray wires individually at installation. Do NOT cap purple and gray wires together.

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D19 / DIML19

DIMMING DRIVER WIRING SCHEMES:

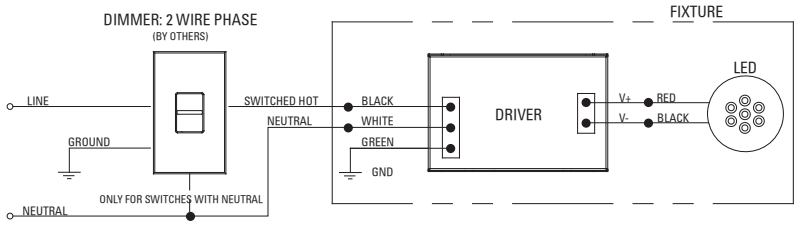
NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D19 / DIML19 LED: Hatch XTC series or equivalent - Forward and Reverse Phase Dimming Driver. Dims down to 1% contingent upon dimmer specification and load. 120V only.

D19 / DIML19
2 WIRE PHASE DIMMING



D19 / DIML19 Dimmer Compatibility Chart

120V ONLY		
Forward Phase / TRIAC Dimming		
Manufacturer	Product	Qty Fixtures Per Dimmer
Leviton	IPL06-10Z	Use fixture wattage per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
	6613-xxx	
Lutron	S-600P	
	S-603P	
	DVSC-603P	
	CT-600P	
	CT-603P	

120V ONLY		
Reverse Phase / ELV Dimming		
Manufacturer	Product	Qty Fixtures Per Dimmer
Leviton	6615	Use fixture wattage per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
	IPE04-xxx	
Lutron	NTELV-300	
	NTELV-600	
	SELV-300P	
	SELV-303P	
	DVELV-300P	
	DVELV-303P	

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www.usailighting.com
info@usailighting.com
1126 River Road
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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D28

DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D28 Dimming Driver Wiring

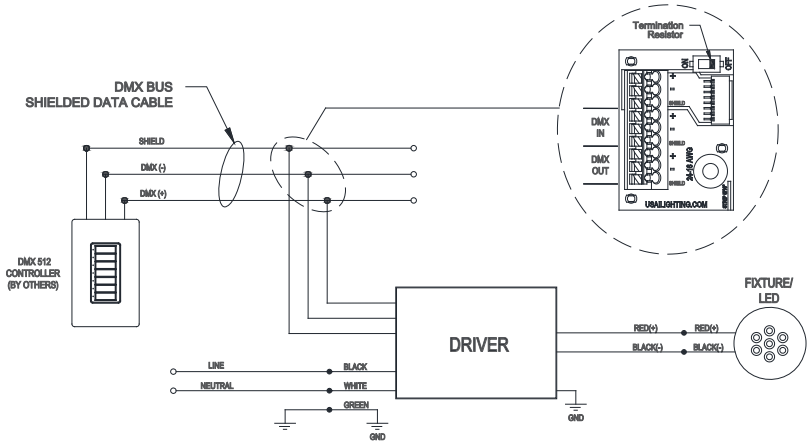
D28 are programmed dimming drivers.
D28 Eldo DMX control dims from 100% to 0.1%

DMX BUS -
SHIELDED DATA CABLE

The data cable used must meet the following requirements:
- type: shielded, 2-conductor twisted pair
- maximum capacitance between conductors: 30 pF/ft
- maximum capacitance between conductor and shield: 55 pF/ft
- maximum resistance: 0.02 ohms/ft
- normal impedance: 100-140 ohms
- conductive core: 24 AWG is recommended

If 3-wire data cables are preferred, we suggest a Belden 9841 or equivalent cable which meets the specifications for EIA RS-485 applications. Do not use standard microphone cables: they cannot transmit DMX512 data reliably over long distances. NOTE: DMX link termination device, provided through Dip Switch on connection board, should be used on last fixture in line on a circuit to avoid signal loss.

D28
DMX CONTROLS



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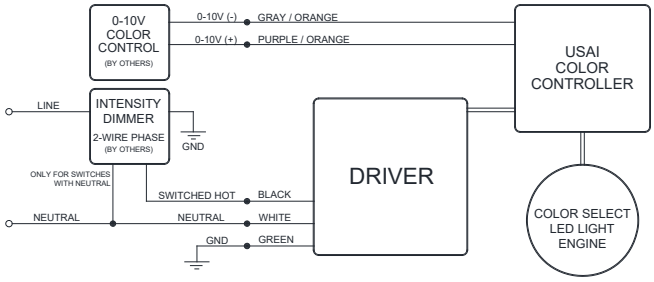
INTENSITY DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML3

INTENSITY DIMMING DRIVER WIRING SCHEMES:

Note: Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

DIML3 LED: Lutron Hi-Lume A-Series 2 Wire Fwd Phase (with neutral) / LED Dimming Driver Wiring (Dims down to 1%) 120V only.



D3 / DIML3 Dimmer Compatibility Chart					
Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Dimmer* Fixture Wattage	
120V Only				39W and Less	40W - 80W
ETC	Sensor+ Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
ETC	Unison DRd Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
Lutron	Maestro Wireless® 600W dimmer	MRF2-6ND-120-	100% - 1%	1 – 8	1 – 4
Lutron	Maestro Wireless® 1000W dimmer	MRF2-10ND-120-	100% - 1%	1 – 13	1 – 6
Lutron	HomeWorks® QS adaptive dimmer	HQRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 600W dimmer	HQRD-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 1000 W dimmer	HQRD-10ND-	100% - 1%	1 – 13	1 – 6
Lutron	Caseta Wireless® Pro 1000W dimmer	PD-10NXD-	100% - 1%	1 – 13	1 – 6
Lutron	Stanza® dimmer	SZ-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 adaptive dimmer	RRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 1000 W dimmer	RRD-10ND-	100% - 1%	1 – 6	1 – 3
Lutron	myRoom DIN power module	MQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® QS wallbox power module	HQRJ-WPM-6D-120-	100% - 1%	1 – 26	1 – 13
Lutron	Homeworks® DIN power module	LQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® wallbox power module	HWI-WPM-6D-120	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® QS control unit	QSGR-, QSGRJ-	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® 3000 control unit	GRX-3100-, GRX-3500-	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4U module	HW-RPM-4U-120, LP-RPM-4U-120	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4A module	HW-RPM-4A-120, LP-RPM-4A-120	100% - 1%	1 – 26	1 – 13
Lutron	GP dimming panels	Various	100% - 1%	1 – 26	1 – 13
Lutron	Ariadni CL 250W dimmer	AYCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Diva CL 250W dimmer	DVCL-253P-, DVSCCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Grafik T CL or RF CL dimmer	GT-250M-, GTJ-250M-	100%-1%	1 – 8	1 – 4
Lutron	Nova T CL 250W dimmer	NTCL-250-	100%-1%	1 – 10	1 – 5

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

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www.usailighting.com
info@usailighting.com

1126 River Road
New Windsor, NY 12553

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INTENSITY DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
DIML4

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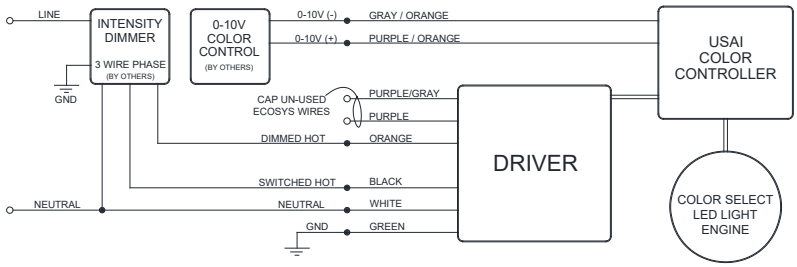
INTENSITY DIMMING DRIVER WIRING SCHEMES:

Note: Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

DIML4 LED: Lutron Hi-Lume A-Series LED Driver with Eco System Control / LED Dimming Driver Wiring (Dims down to 1%)



D4 / DIML4 LED: Lutron Hi-Lume A-Series LED Driver with 3-Wire FL Control / LED Dimming Driver Wiring (Dims down to 1%)

D4 / DIML4 3-Wire Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V Only				39W and Less	40W - 80W
ETC	Sensor+ Cabinet	D20 Dimming module	100% - 1%	1–53	1–26
ETC	Unison DRd Cabinet	D20F Dimming module	100% - 1%	1–53	1–26
Lutron	Nova T	NTF-10-	100%–1%	1–41	1 – 20
Lutron	Nova T	NTF-103P-	100%–1%	1–20	1 – 10
Lutron	Nova	NF-10-	100%–1%	1–41	1 – 20
Lutron	Nova	NF-103P-	100%–1%	1–20	1 – 10
Lutron	Vareo	VF-10-	100%–1%	1–20	1 – 10
Lutron	Skylark	SF-10P-, SF-103P-	100%–1%	1–20	1 – 10
Lutron	Diva	DVF-103P-, DVSCF-103P-	100%–1%	1–20	1 – 10
Lutron	Ariadni	AYF-103P-	100%–1%	1–20	1 – 10
Lutron	Vierti	VTF-6A-	100%–1%	1–15	1 – 7
Lutron	Maestro	MAF-6AM-, MSCF-6AM-	100%–1%	1–15	1 – 7
Lutron	Maestro Wireless	MRF2-F6AN-DV-	100%–1%	1–15	1 – 7
Lutron	RadioRA 2	RRD-F6AN-DV-	100%–1%	1–15	1 – 7
Lutron	HomeWorks QS	HQRD-F6AN-DV	100%–1%	1–15	1 – 7
Lutron	Interfaces	PHPM-3F-120, PHPM-3F-DV	100%–1%	1–41	1 – 20
Lutron	GP Dimming Panels	Various	100%–1%	1–41	1 – 20
277V Only				40W and Less	41W - 80W
ETC	Sensor+ Cabinet	D20 Dimming module	100% - 1%	1–53	1–26
ETC	Unison DRd Cabinet	D20F Dimming module	100% - 1%	1–53	1–26
Lutron	Nova T	NTF-10-277-	100%–1%	1–44	1 – 22
Lutron	Nova T	NTF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Nova	NF-10-277-	100%–1%	1–44	1 – 22
Lutron	Nova	NF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Skylark	SF-12P-277-, SF-12P-277-3	100%–1%	1–33	1 – 16
Lutron	Diva	DVF-103P-277-, DVSCF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Ariadni	AYF-103P-277-	100%–1%	1–44	1 – 22
Lutron	Vierti	VTF-6A-	100%–1%	1–33	1 – 16
Lutron	Maestro	MAF-6AM-277-, MSCF-6AM-277-	100%–1%	1–20	1 – 10
Lutron	Maestro Wireless	MRF2-F6AN-DV-	100%–1%	1–33	1 – 16
Lutron	RadioRA 2	RRD-F6AN-DV-	100%–1%	1–33	1 – 16
Lutron	HomeWorks QS	HQRD-F6AN-DV	100%–1%	1–33	1 – 16
Lutron	Interfaces	PHPM-3F-DV	100%–1%	1–88	1 – 44
Lutron	GP Dimming Panels	Various	100%–1%	1–88	1 – 44

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

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www.usailighting.com
info@usailighting.com

1126 River Road
New Windsor, NY 12553

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INTENSITY DIMMING DRIVER COMPATIBILITY SELECTION GUIDE

DIML4 Continued

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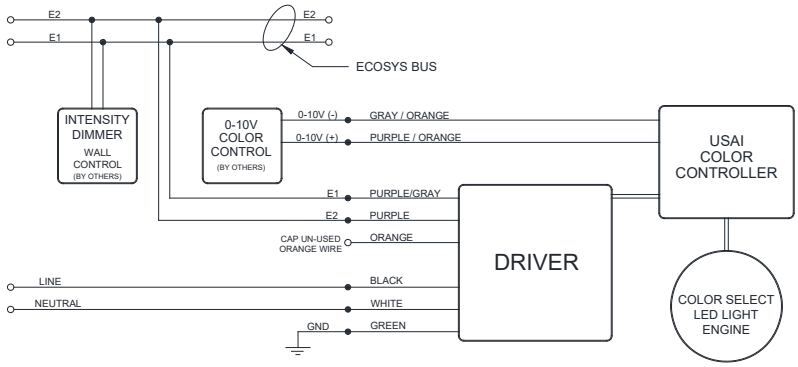
INTENSITY DIMMING DRIVER WIRING SCHEMES:

Note: Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

DIML4 LED: Lutron Hi-Lume A-Series LED Driver with Eco System Control / LED Dimming Driver Wiring (Dims down to 1%)



D4 / DIML4 LED: Lutron Hi-Lume A-Series LED Driver with EcoSystem Control / LED Dimming Driver Wiring (Dims down to

D4 / DIML4 EcoSystem Dimmer Compatibility Chart					
Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V / 277V				39W and Less	40W - 80W
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	100%–1%	1–32	1 – 16
Lutron	Energi Savr Node	QSN-1ECO-S, QSN-2ECO-S	100%–1%	1–64	1 – 32
Lutron	GRAFIK Eye QS (120V ONLY)	QSGRJ- E, QSGR- E	100%–1%	1–64	1 – 32
Lutron	Quantum	Various	100%–1%	1–64	1 – 32

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

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info@usailighting.com

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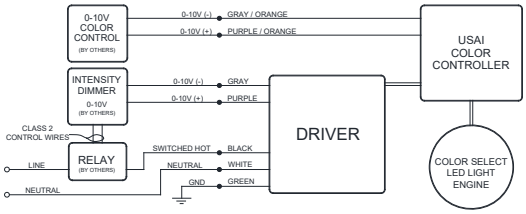
INTENSITY DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
DIML6A & 6B
DIML6E & DIML6F

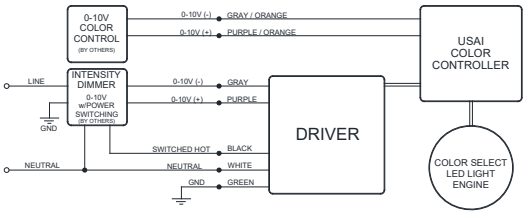
INTENSITY DIMMING DRIVER WIRING SCHEMES:

Note: Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

0-10V Dimming w/ Relay Switch to Power



0-10V Dimming



D6A / DIML6A and D6E / DIML6E LED Dimming Compatibility Table

D6A / DIML6A and D6E / DIML6E are linearly programmed dimming drivers for use with the dimming controls listed in the table below
D6A / DIML6A = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1%
D6E / DIML6E = EldoLED ECOdrive 0-10V control dims from 100% to 1%

D6A / DIML6A and D6E / DIML6E Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range		Qty Fixtures Per Dimmer*
120V & 277V			DIML6A	6E	Refer to manufacturer's dimmer load rating for maximum and minimum fixture quantities per dimmer. Enlighted compatible.
Lutron	Diva	DVTV/NFTV with PP-20	99% - 0.1%	1%	
Lutron	Nova T	NTFTV with PP-20	99% - 0.1%	1%	
Lutron	Energi Savr Node	QSN-4T16-S	100% - 0.1%	1%	
Lutron	GP Dimming Panels	TVM2 Module	99% - 0.1%	1%	
Lutron	Interfaces	GRX-TVI w/ GRX3503	100% - 0.1%	1%	
Sensor Switch	nIO	nIO EZ	100% - 0.1%	1%	
enlighted	Control Unit	CU-3E-1R	100% - 0.1%	1%	

D6B / DIML6B and D6F / DIML6F LED Dimming Compatibility Table

D6B / DIML6B and D6F / DIML6F are logarithmic-programmed dimming drivers for use with the dimming controls listed in the table below
D6B / DIML6B = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1% D6F / DIML6F = EldoLED ECOdrive 0-10V control dims from 100% to 1%

D6B / DIML6B and D6F / DIML6F Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range		Qty Fixtures Per Dimmer*
120V & 277V			DIML6B	6F	Refer to manufacturer's dimmer load rating for maximum and minimum fixture quantities per dimmer. Enlighted compatible.
Bush-Jaeger	Electronic potentiometer	2112U-101	100% - 0.1%	1%	
Jung	Electronic potentiometer	240-10	100% - 0.1%	1%	
Leviton	Illuma Tech dimmer	IP710-DLX	100% - 0.1%	1%	
Lightolier (Philips)	Momentum (120V ONLY)	ZP600FAM120	100% - 0.1%	1%	
Merten	Electronic potentiometer	5729	100% - 0.1%	1%	
Pass & Seymour	Titan	CD4FB-W	100% - 0.1%	1%	
Watt Stopper	Miro	DCLV1	100% - 0.1%	1%	
Synergy	Wallbox Dimmers	ISD BC	100% - 0.1%	1%	
ABB	i-bus	SD/S 2.16.1	100% - 0.1%	1%	
Crestron	Modules	GLX-DIMFLV8, GLXP-DIMFLV8	100% - 0.1%	1%	
Crestron	Green Light	GLPAC-DIMFLV4-, GLPAC-DIMFLV8-	100% - 0.1%	1%	
Crestron	Green Light Power Pack	GLPP-DIMFLVEX-PM, GLPP-1DIMFLV2EX-PM, GLPP-1DIMFLV3EX-PM	100% - 0.1%	1%	
Crestron	DIN Rail Analog Output Module	DIN-A08	100% - 0.1%	1%	
Crestron	DIN Rail 0-10V Fluorescent Dimmer	DIN-4DIMFLV4	100% - 0.1%	1%	
Crestron	iLux 0-10V Dimmer Expansion Module	CLS-EXP-DIMFLV	100% - 0.1%	1%	
enlighted	Control Unit	CU-3E-1R	100% - 0.1%	1%	

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info@usailighting.com

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INTENSITY DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
DIML7

USAI Lighting

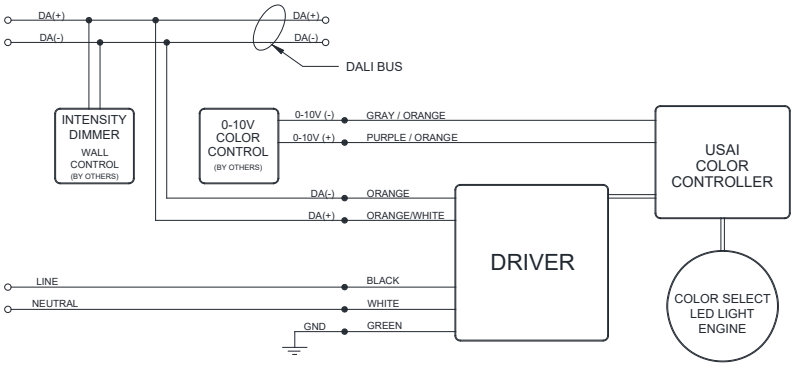
COLOR SELECT®

Covered By US Patents 8,581,520 and 8,456,109

INTENSITY DIMMING DRIVER WIRING SCHEMES:

Note: Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

DIML7 LED: eldoLED DALI dimming driver (dims down to 0.1%)



NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

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BeveLED® 2.2
4.5″ Round Downlight - B4RD

USAI® Lighting

Universal and Field Convertible - Trim | Trimless | Millwork

Trimmed - B4RDF

Trimless - B4RDL

Millwork - B4RDM

usailighting.com/beveled

FEATURES

- Field Flexibility between trimmed, trimless and millwork
- Dry/damp/wet location rated for bathrooms and showers
- 1% dimming standard + more dimming options
- Clear overspray protector for installation convenience
- Full family platform
- Iconic beveled look

COMPANION FAMILY PRODUCTS

Trimless Acoustical - B4RDP
usailighting.com/B4RDP

Deep Regress - B4RC
usailighting.com/B4RC

Adjustable - B4RA
usailighting.com/B4RA

Wall Wash - B4RW
usailighting.com/B4RW

DOWNLIGHT PERFORMANCE DATA

DELIVERED* PERFORMANCE:	LED COLOR CHOICES									
	Classic White						Warm Glow Dimming		Color Select	
	9W	12W	16W	24W	33W	36W	16W	32W	16W	32W
Source Lumens:	1150	1300	1725	2400	3025	4150	1275	2150	1250	2075
Lumens Per Watt:	93	86	86	80	71	99	69	61	60	53
Delivered Lumens:	775	1025	1375	1925	2400	3450	1100	1800	950	1600
EM Mode Output:	575 Delivered Lumens (nominal)						450 Delivered Lumens		475 Delivered Lumens	

*Based on 3000K, 80+ CRI. Performance varies for each specific beamspread and color temperature. See IES files for exact values at usailighting.com.

CORRELATED COLOR TEMPERATURE MULTIPLIER	Classic White						Warm Glow Dimming				Color Select					
	2200K	2700K	2700K	3000K	3500K	4000K	2700K	2700K	3000K	3500K	2200K	2700K	3500K	4000K	5000K	6000K
Color Rendering Index:	80+	80+	90+	90+	80+	80+	80+	90+	90+	80+	80+	80+	80+	80+	80+	80+
Multiplier for Lumen Output:	0.72	0.94	0.78	0.78	1.00	1.06	0.94	0.74	0.80	1.07	0.87	0.96	1.04	1.09	1.13	1.18

THE COMPLETE BEVELED FAMILY PLATFORM

More Ceiling Applications

Sloped Ceiling

BeveLED Block

Cylinders

More Sizes and Shapes

BeveLED Micro

BeveLED Mini

BeveLED 5.0

Armstrong® Ceiling Solutions Compatible

Trimless Acoustical

Connect TechZone

BeveLED Connect

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BeveLED® 2.2
4.5″ Round Downlight - B4RD

USAI® Lighting

Specify fixture part number. (All boxes must be filled in to correctly order)

B4RD__

BeveLED Trim Style

F
Trimmed with Flange (use with all materials)

L
Trimless Spackle-in (use with sheetrock and plaster only)

M
Millwork Knife-Edge (use with wood and stone)

Wattage Options / LED Color Options / Beam Options

Classic White Light

Wattage Options	LED Color Options	Beam Options
09C3 9W LED	**22KS** (1) 2200K, 80+ CRI	**25** 25° beam
12C3 12W LED	**27KS** 2700K, 80+ CRI	**50** 50° beam
16C3 16W LED	**27KH** 2700K, 90+ CRI	**90** 90° beam
24C3 24W LED	**30KS** 3000K, 80+ CRI	
33C3 33W LED	**30KH** 3000K, 90+ CRI	
36E1 36W LED	**35KS** 3500K, 80+ CRI	
	35KH (8) 3500K, 90+ CRI	
	40KS 4000K, 80+ CRI	
	40KH (8) 4000K, 90+ CRI	

Warm Glow Dimming

Wattage Options	LED Color Options	Beam Options
16WG2 16W LED	**2722KS** 2700K-2200K, 80+ CRI	**30** 30° beam
32WG2 32W LED	**2722KH** 2700K-2200K, 90+ CRI	**50** 50° beam
	3022KS 3000K-2200K, 80+ CRI	**90** 90° beam
	3022KH 3000K-2200K, 90+ CRI	
	3522KS 3500K-2200K, 80+ CRI	

Color Select Tunable White

Wattage Options	LED Color Options	Beam Options
16CS1 16W LED	**6022KS** 6000K-2200K, Tunable White Light 80+ CRI	**40** 40° beam
32CS1 32W LED		**60** 60° beam
		90 90° beam

Lens Options

S
Solite (provided standard)

SF
Solite Frosted

BF
Borosilicate Frosted

Bevel Trim Finish Options / *Flange/ Millwork Collar Finish

Bevel Trim Finish Options	*Flange/ Millwork Collar Finish
WH White	**WH** White
GR Grey	**GR** Grey
BL Black	**BL** Black
BZ Bronze	**BZ** Bronze
PR Primer Finish	**PR** Primer Finish
AC Clear Matte Anodized	**AC** Clear Matte Anodized
	WH White
	GR Grey
	BL Black
AB Piano Gloss Black	**AB** Piano Gloss Black
	WH White
	GR Grey
	BL Black
RAL Custom Color Specify RAL #	**RAL** Custom Color Specify RAL #

*Leave blank for Trimless

Housing Options

FT
Flat Housing New Construction (3)

FTIC
Flat Housing IC-Rated (up to 16W maximum) (2, 3)

FTCP
Flat Housing Chicago Plenum (3)

NCSM
New Construction Narrow Width

NC
New Construction

NCCP
Chicago Plenum

NCIC
Insulation Contact Rated / Airtight (1)

Voltage Options
Select one

UNV
120V-277V

120V

347V

Dimming Driver Options

For use with Universal Voltage 120V - 277V

No Additional Charge

D6E
EldoLED 0-10V, 1% (provided standard)

D6F
EldoLED 0-10V, 1%

D4
Lutron 3-wire/ECO, 1%

D4E
Lutron 5 ECO, 5% (5)

D4H
Lutron H ECO, 1% Fade (5)

D6A
EldoLED 0-10V, 0.1%

D6B
EldoLED 0-10V, 0.1%

D7
EldoLED DALI, 0.1%

D18
Moons DMX, 1% (2, 3)

For use with 120V only

No Additional Charge

D19
Phase 2-wire, 1% (2, 3, 5, 6)

D3
Lutron 2-wire, 1% (4)

For use with 347V only

D15
0-10V dim, 1% 347V only (2, 3)

Acessories (Optional)

CB27
27" C-Channel Bars

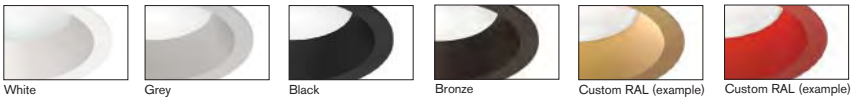
CB52
52" C-Channel Bars

EM
Emergency Battery (7)

EMW
Emergency Battery Wet Location (7)

Notes:
1 Not available with 36E1LED
2 Not available for Warm Glow.
3 Not available for Color Select.
4 Not available with 16W FTIC.
5 Not available with 9W.
6 Not available with 33W.
7 Not available with 347V. For NC and NCSM housings only. NCSM housing requires above ceiling access.
8 Not available with C3 LED

TRIM FINISH OPTIONS



White | Grey | Black | Bronze | Custom RAL (example) | Custom RAL (example)

Custom colors and primer finish also available

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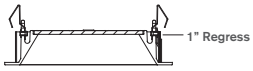
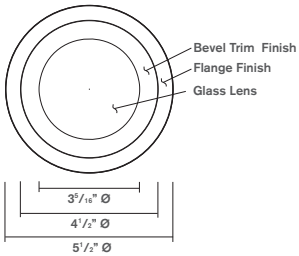
USAI® Lighting

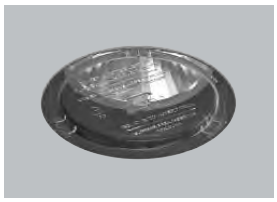
Trimmed - B4RDF

TRIM DETAILS

Trimmed - B4RDF





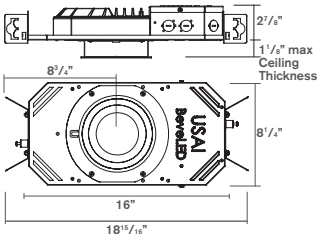


Clear acrylic overspray protector provided standard with every housing to keep out dust and contaminants during construction. Allows for use as work light.

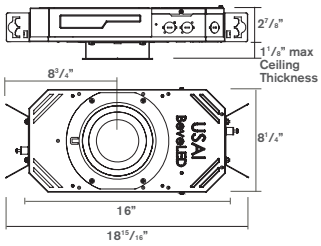
HOUSING OPTIONS

Flat Housing - FT

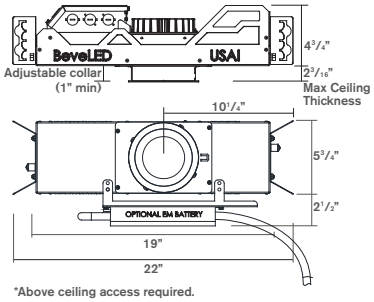
Flat Housing, Chicago Plenum - FTCP



Flat Housing, IC-Rated - FTIC
(up to 16W maximum)

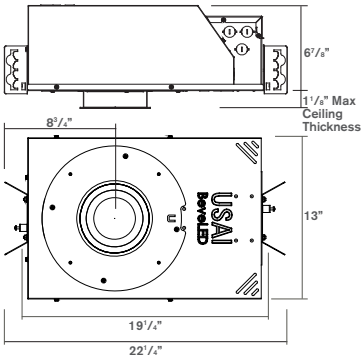


New Construction Narrow Width - NCSM
NCSM with Emergency Battery*

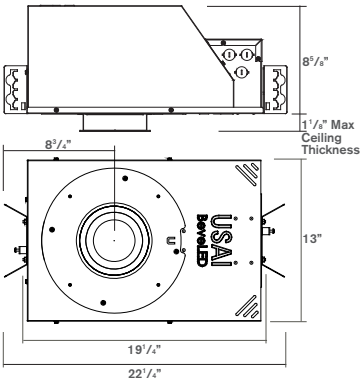


*Above ceiling access required.

New Construction - NC
Insulation-Contact Rated (24W Max) - NCIC
Chicago Plenum Rated (24W Max) - NCCP
NC with Emergency Battery



Insulation-Contact Rated (32W-33W) - NCIC
Chicago Plenum Rated (32W-36W) - NCCP



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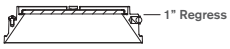
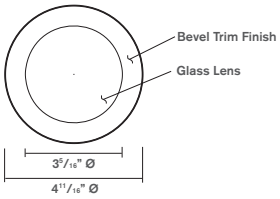
Trimless - B4RDL

TRIM DETAILS

Trimless - B4RDL



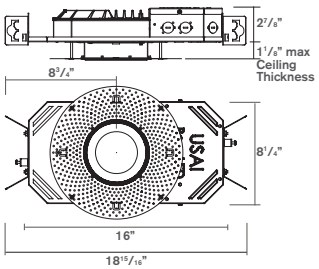


Clear acrylic overspray protector provided standard with every housing to keep out dust and contaminants during construction. Allows for use as work light.

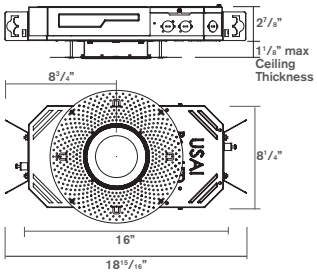
HOUSING OPTIONS

Flat Housing - FT

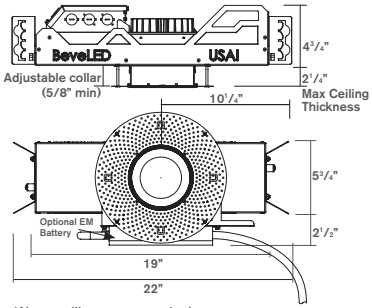
Flat Housing, Chicago Plenum - FTCP



Flat Housing, IC-Rated - FTIC
(up to 16W maximum)

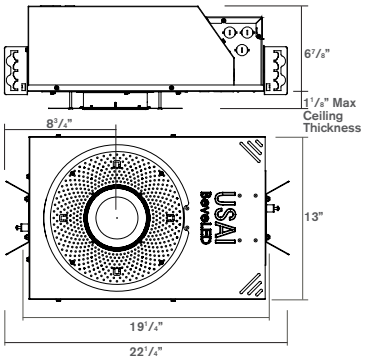


New Construction Narrow Width - NCSM
NCSM with Emergency Battery*

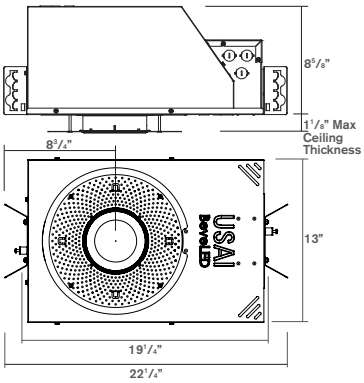


*Above ceiling access required.

New Construction - NC
Insulation-Contact Rated (24W Max) - NCIC
Chicago Plenum Rated (24W Max) - NCCP
NC with Emergency Battery



Insulation-Contact Rated (32W-33W) - NCIC
Chicago Plenum Rated (32W-36W) - NCCP



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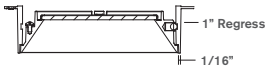
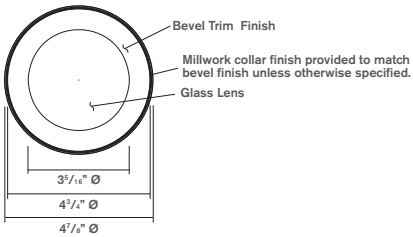
Millwork - B4RDM

TRIM DETAILS

Millwork - B4RDM



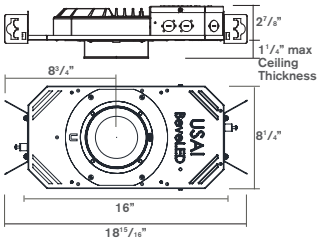


Clear acrylic overspray protector provided standard with every housing to keep out dust and contaminants during construction. Allows for use as work light.

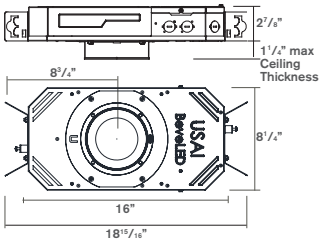
HOUSING OPTIONS

Flat Housing - FT

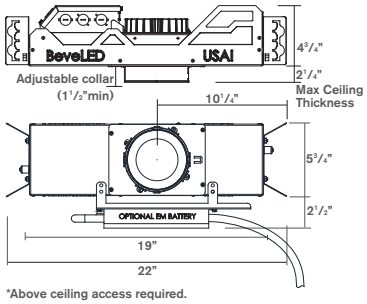
Flat Housing, Chicago Plenum - FTCP



Flat Housing, IC-Rated - FTIC
(up to 16W maximum)

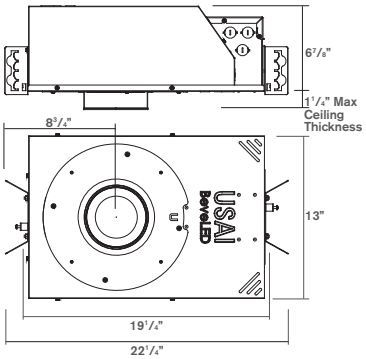


New Construction Narrow Width - NCSM
NCSM with Emergency Battery*

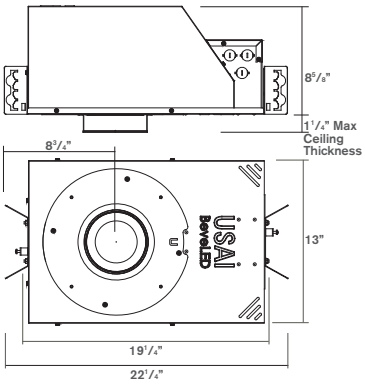


*Above ceiling access required.

New Construction - NC
Insulation-Contact Rated (24W Max) - NCIC
Chicago Plenum Rated (24W Max) - NCCP
NC with Emergency Battery



Insulation-Contact Rated (32W-33W) - NCIC
Chicago Plenum Rated (32W-36W) - NCCP



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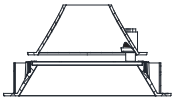
USAI® Lighting

BEVELED 2.2 SPECIFICATIONS

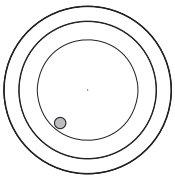
FIELD REPLACEABLE LED LIGHT ENGINE
is serviceable through the aperture without tools or with a Philips screwdriver. All USAI Lighting light engines feature industry-leading color consistency.

FIELD REPLACEABLE DRIVER
Unless otherwise specified, a 0-10V, 100%-1% solid state electronic constant current integral D6E dimming driver with a high power factor is provided standard and sources 2mA. All integral dimming drivers are located within the fixture housing and are serviceable from below the ceiling through the aperture. Some on-time delay may be experienced depending on control system used. All dimming drivers comply with IEEE C62.41 surge protection.

EMERGENCY BATTERY
IOTA emergency battery provides backup power for 90 minutes. NC EM fixtures are provided with an integral emergency battery with integral test switch for narrow and medium beamspreads and can be serviced through the aperture from below the ceiling plane. NC EM fixtures with 80° and 90° optics must be provided with remote test switches. NCSM EM fixtures are provided with an integral emergency battery with a remote test switch, which comes with a 24" lead length for location of the test switch. Remote EM test switch is dry/damp only; select EMW emergency option for a wet location-rated EM test switch. NCSM EM fixtures require above ceiling access for service of the EM pack. Fixtures that have no USAI EM option may be connected to an inverter (by others) for emergency lighting. Battery is not available with 347V.



Integral Emergency Test Switch included with NC housing with 25° - 60° optics



Remote Emergency Test Switch included with NCSM housing (above ceiling access required). Also included with NC housing when 80° and 90° optics are used.

HOUSING
All BeveLED 2.2 fixtures are field-felxible which allows for field changes from trimless or millwork to trimmed with a simple components change with parts from USAI. Housings are fabricated of 20 ga. steel construction with thru wire J-box, 4 in 4 out at min. 90°C, #12 AWG thru branch circuit wiring, except for NCSM which is fabricated of 18 ga. steel. FTIC and NCIC housing for use with 9W, 12W, and 16W light engines only are rated for direct contact with spray foam insulation of R-42 or less. FTIC housing is IC-rated up to 16W maximum, NCIC housing is IC-rated up to 33W maximum.

MOUNTING
B4RDF overlap flange fixtures are designed for use in sheetrock, acoustical ceiling tile, and many other ceiling materials. B4RDL trimless fixtures are provided with a spackle collar and are designed for use in sheetrock/mud-in ceiling applications. B4RDM millwork fixtures are provided with a millwork collar in finish to match trim finish specified and are designed for use in wood/millwork, stone and tile construction applications. Butterfly brackets and adjustable nailer bars extendible from 14" to 24" centers with integral nails are provided for attachment to building structure. C-channel bars are optionally available for acoustical ceiling applications.

FIXTURE WEIGHT
FT, FTIC, and FTCP housings weigh 8 lbs. NC, NCIC, and NCCP housings weigh 16 lbs. NCSM housing weighs 10 lbs., NCSM with EM weighs 16.5 lbs, and NC housing with EM weighs 24.5 lbs.

WARRANTY
Based on IESNA LM80-2008, BeveLED has a 50,000 hour rated life at 70% lumen maintenance (L70). USAI Lighting Warranty covers replacement parts for 5 years from date of shipment. Ambient temperatures at fixture location should not exceed 40°C during normal operation.

CEILING CUT OUT
B4RDF Trimmed with Overlap Flange: 5-1/16" ∅
B4RDL Trimless Spackle-in: 5-1/2" ∅
B4RDM Millwork Knife-edge: 4-15/16" ∅

LISTINGS
Dry/Damp/Wet location. AC and AB trim finishes are dry/damp only. Remote EM test switch is dry/damp only. Select EMW option for wet location remote test switch. UL2043 rated for use in air handling plenums. NRTL/CSA-US tested to UL standards. IBEW union made.

NOTES
- Not for use in corrosive environment
- Use of pressure washer voids warranty

PHOTOMETRICS
Consult factory or website for IES files. Tested in accordance with IESNA LM79.

USAI LIGHTING COLLABORATORY
13 Crosby Street
New York, NY 10013
845-234-4090
showroom@usailighting.com

USAI LIGHTING HEADQUARTERS
1126 River Road
New Windsor, NY 12553
T: 845–565–8500
info@usailighting.com

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USAI® Lighting

LED COLOR OPTIONS

Classic White Light

Our proprietary LED light engines achieve a 2-step MacAdam ellipse along the black body locus, resulting in reliable and uniform color from fixture to fixture. You'll see the results in consistently beautiful light throughout your space, whichever USAI LED product you specify.


Warm Glow® Dimming

Warm Glow Dimming provides warmth and glow once possible only in dimmed incandescent sources. Utilizing our patented proprietary algorithm and circuitry, Warm Glow Dimming technologies precisely mimic the black body curve of a standard 100W A19 lamp by gradually transitioning from 2700K , 3000K or 3500K down to 2200K. The result is virtually indistinguishable from an incandescent light source.


Color Select® Tunable White

Color Select represents the next innovation in color temperature control for advanced LED recessed downlighting. Color Select® products allow users to adjust color temperature from 6000K down to 2200K while independently adjusting intensity to achieve ultimate control over the quality of light in a space with a single fixture type. Color Select interfaces with standard dimming and control systems.


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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D3 / DIML3

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

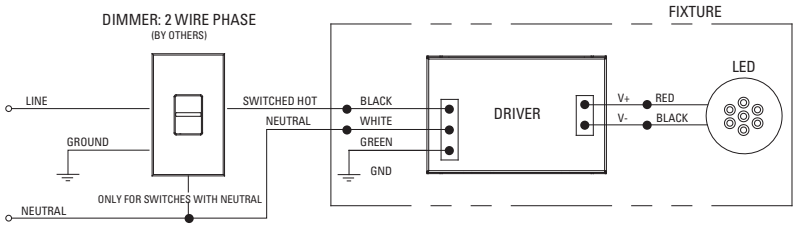
D3 / DIML3 LED: Lutron Hi-Lume A-Series 2 Wire Fwd Phase (with neutral) / LED Dimming Driver Wiring (Dims down to 1%) 120V

D3 / DIML3 Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Dimmer* Fixture Wattage	
120V Only				39W and Less	40W - 80W
ETC	Sensor+ Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
ETC	Unison DRd Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
Lutron	Maestro Wireless® 600W dimmer	MRF2-6ND-120-	100% - 1%	1 – 8	1 – 4
Lutron	Maestro Wireless® 1000W dimmer	MRF2-10ND-120-	100% - 1%	1 – 13	1 – 6
Lutron	HomeWorks® QS adaptive dimmer	HQRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 600W dimmer	HQRD-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 1000 W dimmer	HQRD-10ND-	100% - 1%	1 – 13	1 – 6
Lutron	Caseta Wireless® Pro 1000W dimmer	PD-10NXD-	100% - 1%	1 – 13	1 – 6
Lutron	Stanza® dimmer	SZ-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 adaptive dimmer	RRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 1000 W dimmer	RRD-10ND-	100% - 1%	1 – 6	1 – 3
Lutron	myRoom DIN power module	MQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® QS wallbox power module	HQRJ-WPM-6D-120-	100% - 1%	1 – 26	1 – 13
Lutron	Homeworks® DIN power module	LQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® wallbox power module	HWI-WPM-6D-120	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® QS control unit	QSGR-, QSGRJ-	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® 3000 control unit	GRX-3100-, GRX-3500-	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4U module	HW-RPM-4U-120, LP-RPM-4U-120	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4A module	HW-RPM-4A-120, LP-RPM-4A-120	100% - 1%	1 – 26	1 – 13
Lutron	GP dimming panels	Various	100% - 1%	1 – 26	1 – 13
Lutron	Ariadni CL 250W dimmer	AYCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Diva CL 250W dimmer	DVCL-253P-, DVSCCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Grafik T CL or RF CL dimmer	GT-250M-, GTJ-250M-	100%-1%	1 – 8	1 – 4
Lutron	Nova T CL 250W dimmer	NTCL-250-	100%-1%	1 – 10	1 – 5

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

D3 / DIML3
2 WIRE PHASE DIMMING



USAI Lighting

www.usailighting.com
info@usailighting.com

1126 River Road
New Windsor, NY 12553

T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE D4 / DIML4

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DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D4 / DIML4 LED: Lutron Hi-Lume A-Series LED Driver with 3-Wire FL Control / LED Dimming Driver Wiring (Dims down to 1%)

D4 / DIML4 3-Wire Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V Only				39W and Less	40W - 80W
ETC	Sensor+ Cabinet	D20 Dimming module	100% - 1%	1–53	1–26
ETC	Unison DRd Cabinet	D20F Dimming module	100% - 1%	1–53	1–26
Lutron	Nova T	NTF-10-	100%–1%	1–41	1 – 20
Lutron	Nova T	NTF-103P-	100%–1%	1–20	1 – 10
Lutron	Nova	NF-10-	100%–1%	1–41	1 – 20
Lutron	Nova	NF-103P-	100%–1%	1–20	1 – 10
Lutron	Vareo	VF-10-	100%–1%	1–20	1 – 10
Lutron	Skylark	SF-10P-, SF-103P-	100%–1%	1–20	1 – 10
Lutron	Diva	DVF-103P-, DVSCF-103P-	100%–1%	1–20	1 – 10
Lutron	Ariadni	AYF-103P-	100%–1%	1–20	1 – 10
Lutron	Vierti	VTF-6A-	100%–1%	1–15	1 – 7
Lutron	Maestro	MAF-6AM-, MSCF-6AM-	100%–1%	1–15	1 – 7
Lutron	Maestro Wireless	MRF2-F6AN-DV-	100%–1%	1–15	1 – 7
Lutron	RadioRA 2	RRD-F6AN-DV-	100%–1%	1–15	1 – 7
Lutron	HomeWorks QS	HQRD-F6AN-DV	100%–1%	1–15	1 – 7
Lutron	Interfaces	PHPM-3F-120, PHPM-3F-DV	100%–1%	1–41	1 – 20
Lutron	GP Dimming Panels	Various	100%–1%	1–41	1 – 20
277V Only				40W and Less	41W - 80W
ETC	Sensor+ Cabinet	D20 Dimming module	100% - 1%	1–53	1–26
ETC	Unison DRd Cabinet	D20F Dimming module	100% - 1%	1–53	1–26
Lutron	Nova T	NTF-10-277-	100%–1%	1–44	1 – 22
Lutron	Nova T	NTF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Nova	NF-10-277-	100%–1%	1–44	1 – 22
Lutron	Nova	NF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Skylark	SF-12P-277-, SF-12P-277-3	100%–1%	1–33	1 – 16
Lutron	Diva	DVF-103P-277-, DVSCF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Ariadni	AYF-103P-277-	100%–1%	1–44	1 – 22
Lutron	Vierti	VTF-6A-	100%–1%	1–33	1 – 16
Lutron	Maestro	MAF-6AM-277-, MSCF-6AM-277-	100%–1%	1–20	1 – 10
Lutron	Maestro Wireless	MRF2-F6AN-DV-	100%–1%	1–33	1 – 16
Lutron	RadioRA 2	RRD-F6AN-DV-	100%–1%	1–33	1 – 16
Lutron	HomeWorks QS	HQRD-F6AN-DV	100%–1%	1–33	1 – 16
Lutron	Interfaces	PHPM-3F-DV	100%–1%	1–88	1 – 44
Lutron	GP Dimming Panels	Various	100%–1%	1–88	1 – 44

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

DIML4 wiring diagrams continued on next page

USAI Lighting
www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D4 / DIML4 Continued

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

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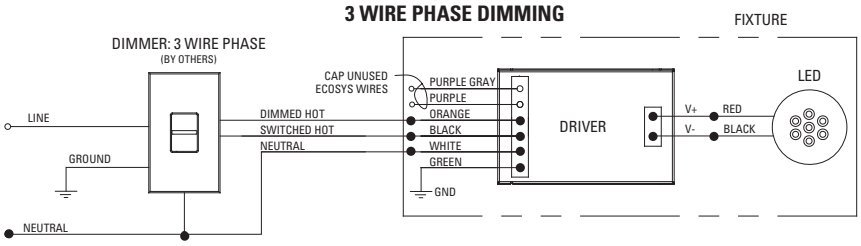
5. Cap any wires not used separately (not together).

D4 / DIML4 LED: Lutron Hi-Lume A-Series LED Driver with 3-Wire FL Control / LED Dimming Driver Wiring (Dims down to 1%)

D4 / DIML4
3 WIRE PHASE DIMMING

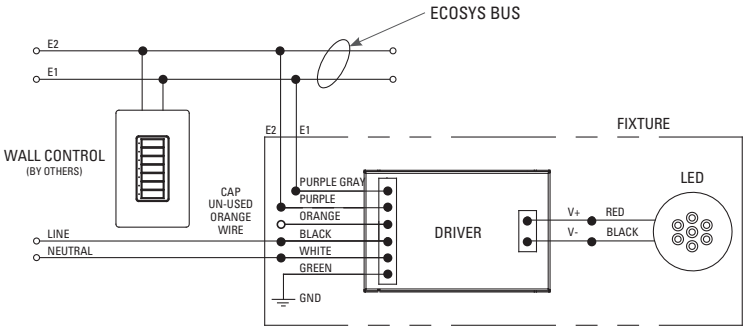


D4 / DIML4 LED: Lutron Hi-Lume A-Series LED Driver with EcoSystem Control / LED Dimming Driver Wiring (Dims down to

D4 / DIML4 EcoSystem Dimmer Compatibility Chart					
Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V / 277V				39W and Less	40W - 80W
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	100%–1%	1–32	1 – 16
Lutron	Energi Savr Node	QSN-1ECO-S, QSN-2ECO-S	100%–1%	1–64	1 – 32
Lutron	GRAFIK Eye QS (120V ONLY)	QSGRJ- E, QSGR- E	100%–1%	1–64	1 – 32
Lutron	Quantum	Various	100%–1%	1–64	1 – 32

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

D4 / DIML4
EcoSystem CONTROLS



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www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D4E / DIML4E and D4H /DIML4H

DIMMING DRIVER WIRING SCHEMES:

NOTES:

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5. Cap any wires not used separately (not together).

D4E / DIML4E LED: Lutron 5 Series EcoSystem LED Driver / LED Dimming Driver Wiring (Dims down to 5%)

D4E / DIML4E EcoSystem Dimmer Compatibility Chart					
Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V / 277V				39W and Less	40W - 80W
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	100%–5%	1–32	1 – 16
Lutron	Energi Savr Node	QSN-1ECO-S, QSN-2ECO-S	100%–5%	1–64	1 – 32
Lutron	GRAFIK Eye QS (120V ONLY)	QSGRJ- E, QSGR- E	100%–5%	1–64	1 – 32
Lutron	Quantum	Various	100%–5%	1–64	1 – 32

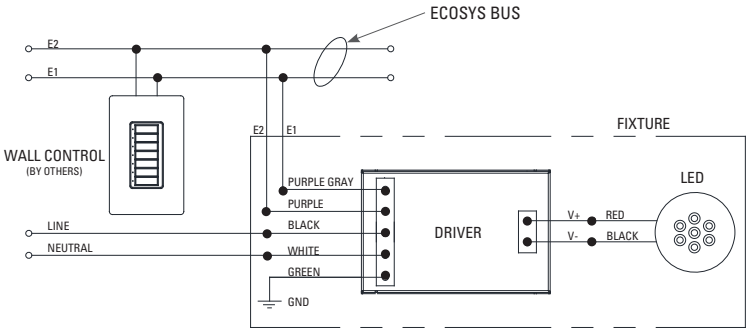
* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

D4H / DIML4H LED: Lutron H Series EcoSystem LED Driver with Fade to Black (dims down to 1%)

D4H / DIML4H EcoSystem Dimmer Compatibility Chart					
Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V / 277V				39W and Less	40W - 80W
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	100%–1%	1–32	1 – 16
Lutron	Energi Savr Node	QSN-1ECO-S, QSN-2ECO-S	100%–1%	1–64	1 – 32
Lutron	GRAFIK Eye QS (120V ONLY)	QSGRJ- E, QSGR- E	100%–1%	1–64	1 – 32
Lutron	Quantum	Various	100%–1%	1–64	1 – 32

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

D4E / DIML4E and D4H / DIML 4H EcoSystem CONTROLS



USAI Lighting

www.usailighting.com
info@usailighting.com

1126 River Road
New Windsor, NY 12553

T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D6A / DIML6A and D6E / DIML6E
D6B / DIML6B and D6F / DIML6F

IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

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5. Cap any wires not used separately (not together).

D6A / DIML6A and D6E / DIML6E LED Dimming Compatibility Table

D6A / DIML6A and D6E / DIML6E are linearly programmed dimming drivers for use with logarithmic-style dimming controls (e.g., Lutron and others listed in the table below)
D6A / DIML6A = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1%
D6E / DIML6E = EldoLED ECOdrive 0-10V control dims from 100% to 1%

D6A / DIML6A and D6E / DIML6E Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range DIML6A		DIML6E	Qty Fixtures Per Dimmer*
120V & 277V						Refer to manufacturer's dimmer load rating for maximum and minimum fixture quantities per dimmer. Enlighted compatible.
Lutron	Diva	DVTV/NFTV with PP-20	99% -	0.1%	1%	
Lutron	Nova T	NTFTV with PP-20	99% -	0.1%	1%	
Lutron	Energi Savr Node	QSN-4T16-S	100% -	0.1%	1%	
Lutron	GP Dimming Panels	TVM2 Module	99% -	0.1%	1%	
Lutron	Interfaces	GRX-TVI w/ GRX3503	100% -	0.1%	1%	
Sensor Switch	nIO	nIO EZ	100% -	0.1%	1%	
enlighted	Control Unit	CU-3E-1R	100% -	0.1%	1%	

D6B / DIML6B and D6F / DIML6F LED Dimming Compatibility Table

D6B / DIML6B and D6F / DIML6F are logarithmic-programmed dimming drivers for use with linear-style dimming controls (e.g., Crestron, non-Lutron and others listed below)
D6B / DIML6B = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1% D6F / DIML6F = EldoLED ECOdrive 0-10V control dims from 100% to 1%

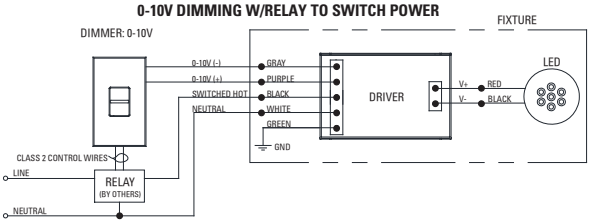
D6B / DIML6B and D6F / DIML6F Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range DIML6B		6F	Qty Fixtures Per Dimmer*
120V & 277V						Refer to manufacturer's dimmer load rating for maximum and minimum fixture quantities per dimmer. Enlighted compatible.
Bush-Jaeger	Electronic potentiometer	2112U-101	100% -	0.1%	1%	
Jung	Electronic potentiometer	240-10	100% -	0.1%	1%	
Leviton	Iluma Tech dimmer	IP710-DLX	100% -	0.1%	1%	
Lightolier (Philips)	Momentum (120V ONLY)	ZP600FAM120	100% -	0.1%	1%	
Merten	Electronic potentiometer	5729	100% -	0.1%	1%	
Pass & Seymour	Titan	CD4FB-W	100% -	0.1%	1%	
Watt Stopper	Miro	DCLV1	100% -	0.1%	1%	
Synergy	Wallbox Dimmers	ISD BC	100% -	0.1%	1%	
ABB	i-bus	SD/S 2.16.1	100% -	0.1%	1%	
Crestron	Modules	GLX-DIMFLV8, GLXP-DIMFLV8	100% -	0.1%	1%	
Crestron	Green Light	GLPAC-DIMFLV4-, GLPAC-DIMFLV8-	100% -	0.1%	1%	
Crestron	Green Light Power Pack	GLPP-DIMFLVEX-PM, GLPP-1DIMFLV2EX-PM, GLPP-1DIMFLV3EX-PM	100% -	0.1%	1%	
Crestron	DIN Rail Analog Output Module	DIN-A08	100% -	0.1%	1%	
Crestron	DIN Rail 0-10V Fluorescent Dimmer	DIN-4DIMFLV4	100% -	0.1%	1%	
Crestron	iLux 0-10V Dimmer Expansion Module	CLS-EXP-DIMFLV	100% -	0.1%	1%	
enlighted	Control Unit	CU-3E-1R	100% -	0.1%	1%	

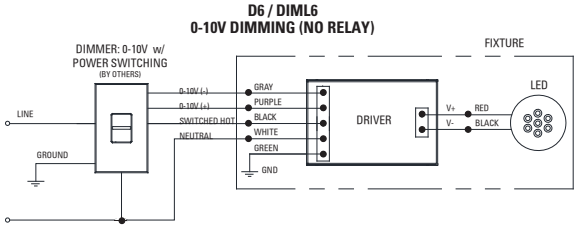
DIMMING DRIVER WIRING SCHEMES:

NOTES: Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

D6 / DIML6
0-10V DIMMING W/RELAY TO SWITCH POWER



D6 / DIML6
0-10V DIMMING (NO RELAY)



USAI Lighting
www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D7 / DIML7 and D7E

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

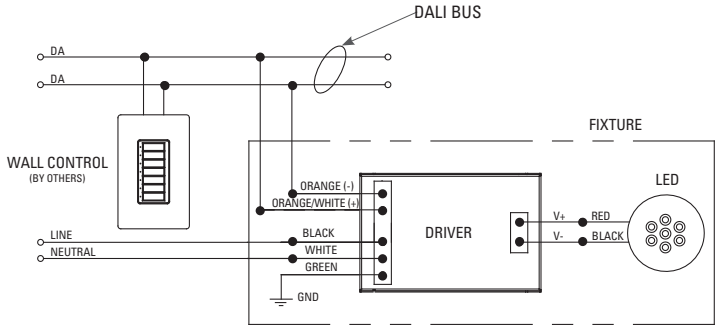
IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D7 / DIML7 and D7E Dimming Driver Wiring

D7 / DIML7 and D7E are linearly programmed dimming drivers.
D7 / DIML7 = EldoLED SOLOdrive DALI control dims from 100% to 0.1%
D7E = EldoLED ECOdrive DALI control dims from 100% to 1%

D7 / DIML7 / D7E
DALI CONTROLS



USAI Lighting
www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D8 / DIML8 and D8E

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D8 / DIML8 and D8E Dimming Driver Wiring

D8 / DIML8 and D8E are linearly programmed dimming drivers.
D8 / DIML8 = EldoLED POWERdrive DMX control dims from 100% to 0.1%
D8E = EldoLED POWERdrive DMX control dims from 100% to 1%

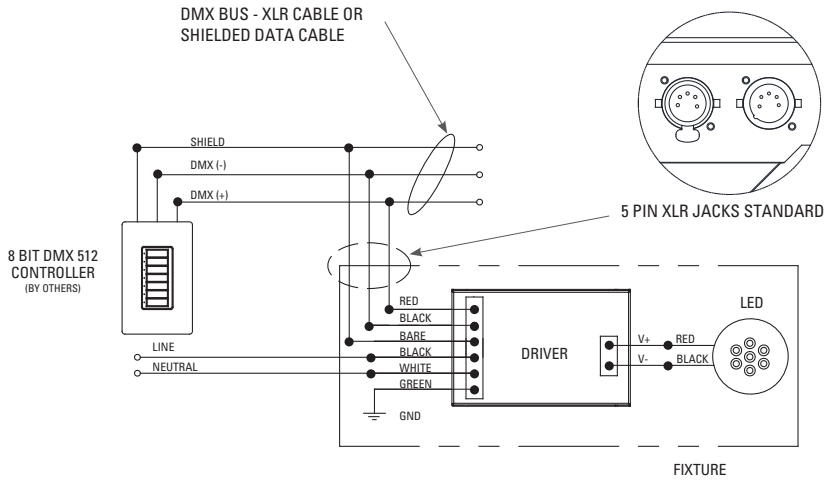
DMX BUS - XLR CABLE OR
SHIELDED DATA CABLE

The data cable used must meet the following requirements:

- type: shielded, 2-conductor twisted pair
- maximum capacitance between conductors: 30 pF/ft
- maximum capacitance between conductor and shield: 55 pF/ft
- maximum resistance: 0.02 ohms/ft
- normal impedance: 100-140 ohms
- conductive core: 24 AWG is recommended

If 3-wire data cables are preferred, we suggest a Belden 9841 or equivalent cable which meets the specifications for EIA RS-485 applications. Do not use standard microphone cables: they cannot transmit DMX512 data reliably over long distances. NOTE: DMX link termination device (by others) should be used on last fixture in line on a circuit to avoid signal loss.

D8 / DIML8 / D8E
DMX CONTROLS



USAI Lighting

www.usailighting.com
info@usailighting.com

1126 River Road
New Windsor, NY 12553

T 845–565–8500
F 845–561–1130

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Type

R3 - DMX

Cut sheet 14 of 16

DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D15 / DIML15

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

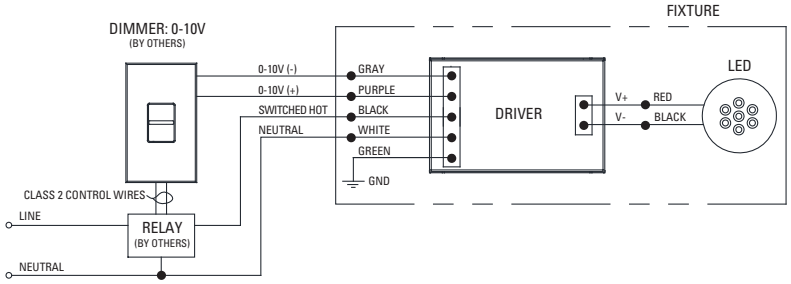
1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D15 / DIML15 LED: 0-10V, 347V Dimming Driver Wiring (Dims down to 1%) 347V Only

D15 / DIML15 Dimmer Compatibility Chart			
Manufacturer	Product	Dimmed Light Output Range	Qty Fixtures Per Dimmer*
347			Use source current per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
Acuity	Synergy ISD-BC	100% - 1%	
Douglas Lighting	WPN-5721, WPN-5822	100% - 1%	
Hubbell	Light Hawk2 LHD-IRS3-N347-xx	100% - 1%	
Leviton	Illumatech IP710-DLZ with 347V relay	100% - 1%	
Leviton	Centura Fluorescent Control System	100% - 1%	
Lutron	Nova NFTV-* dimmer plus 347V relay	100% - 1%	
Lutron	Diva DVTV-* dimmer plus 347V relay	100% - 1%	

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

D15 / DIML15
0-10V DIMMING W/RELAY TO SWITCH POWER



NOTE:
If switched, non-dimming operation is desired, cap off purple and gray wires individually at installation. Do NOT cap purple and gray wires together.

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info@usailighting.com
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New Windsor, NY 12553
T 845–565–8500
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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D18

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D18 Dimming Driver Wiring

D18 are programmed dimming drivers.
D18 Moons DMX control dims from 100% to 1%

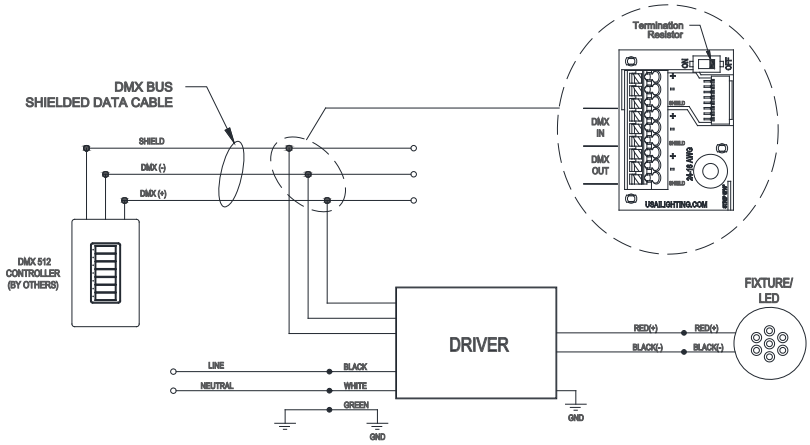
DMX BUS -
SHIELDED DATA CABLE

The data cable used must meet the following requirements:

- type: shielded, 2-conductor twisted pair
- maximum capacitance between conductors: 30 pF/ft
- maximum capacitance between conductor and shield: 55 pF/ft
- maximum resistance: 0.02 ohms/ft
- normal impedance: 100-140 ohms
- conductive core: 24 AWG is recommended

If 3-wire data cables are preferred, we suggest a Belden 9841 or equivalent cable which meets the specifications for EIA RS-485 applications. Do not use standard microphone cables: they cannot transmit DMX512 data reliably over long distances. NOTE: DMX link termination device, provided through Dip Switch on connection board, should be used on last fixture in line on a circuit to avoid signal loss.

D18
DMX CONTROLS



USAI Lighting

www.usailighting.com
info@usailighting.com

1126 River Road
New Windsor, NY 12553

T 845–565–8500
F 845–561–1130

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R3 - DMX

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BeveLED Mini® Complete - B3RW
3″ Round Wall Wash

USAI® Lighting

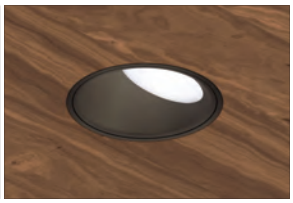
Universal and Field Convertible - Trim | Trimless | Millwork

Trimmed - B3RWF

usailighting.com/beveledmini

Trimless - B3RWL

Millwork - B3RWM



Trimless Acoustical Tile - B3RWP

To specify Trimless Acoustical Lighting visit usailighting.com/B3RWP

Introducing new and improved BeveLED Mini, the smallest member of of our iconic BeveLED family. BeveLED Mini has been infused with upgraded performance for superior light in every application. Now available with the following features, by popular demand:

FEATURES

- Upgraded performance and more LED color options than ever before!
- Field Flexibility - it's now easy to change trim in the field between trimmed, trimless and millwork
- Dry/damp/wet location rated for bathrooms and showers, including trimless and millwork
- More dimming options and all color technologies available
- Clear overspray protector for installation convenience
- Full family platform
- Iconic beveled look

WALL WASH PERFORMANCE DATA

LED COLOR CHOICES

DELIVERED* PERFORMANCE:	Classic White			Warm Glow Dimming		Color Select	
	9W	15W	20W	15W	20W	12W	18W
Source Lumens:	1175	1825	2475	1350	1800	925	1200
Lumens Per Watt:	69	69	67	52	51	46	41
Delivered Lumens:	625	975	1325	775	1050	550	750

*Based on 3000K, 80+ CRI. Performance varies for each specific beamspread and color temperature. See IES files for exact values at usailighting.com.

CORRELATED COLOR TEMPERATURE MULTIPLIER	Classic White											
	2700K			3000K			3500K			4000K		
Color Rendering Index:	80+	90+	95+	80+	90+	95+	80+	90+	95+	80+	90+	95+
Multiplier for Lumen	0.96	0.81	0.70	1.00	0.86	0.74	1.03	0.88	0.79	1.06	0.81	0.81

	Warm Glow Dimming					Color Select						
	2700K		3000K		3500K	2200K	2700K	3000K	3500K	4000K	5000K	6000K
Color Rendering Index:	80+	90+	80+	90+	80+	80+	80+	80+	80+	80+	80+	80+
Multiplier for Lumen	1.00	0.78	1.00	0.83	1.05	0.92	0.97	1.00	1.03	1.05	1.10	1.13

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13 Crosby Street
New York, NY 10013
845-234-4090
showroom@usailighting.com

USAI LIGHTING HEADQUARTERS
1126 River Road
New Windsor, NY 12553
T: 845–565–8500 F: 845–561–1130
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BeveLED Mini® Complete - B3RW
3″ Round Wall Wash with Integral Driver Housings

USAI® Lighting

Specify fixture part number. (All boxes must be filled in to correctly order)

B3RW__			W2-D1						
BeveLED Trim Style	**Wattage Options**	**LED Color Options**	**Beam Options**	**Bevel Trim Finish Options**	***Flange/ Millwork Collar Finish**	**Housing Options**	**Voltage Options** *Select one*	**Dimming Driver Options**	**Acessories (Optional)***
F Trimmed with Flange (use with all materials) **L** Trimless Spackle-in (use with sheetrock and plaster only) **M** Millwork Knife-Edge (use with wood and stone)	**Classic White Light** **09X3** 9W LED **15X3** 15W LED **20X3** 20W LED	**27KS** 2700K, 80+ CRI **27KH** 2700K, 90+ CRI **27KU** 2700K, 95+ CRI **30KS** 3000K, 80+ CRI **30KH** 3000K, 90+ CRI **30KU** 3000K, 95+ CRI **35KS** 3500K, 80+ CRI **35KH** 3500K, 90+ CRI **35KU** 3500K, 95+ CRI **40KS** 4000K, 80+ CRI **40KH** 4000K, 90+ CRI **40KU** 4000K, 95+ CRI	**W2-D1** Horizontal Wall Wash Optic	**WH** White **SC** Conduit Silver **GR** Grey **BL** Black **BZ** Bronze **PR** Primer Finish **AC** Clear Matte Anodized **AB** Piano Gloss Black **RAL** Custom Color Specify RAL #	**WH** White **SC** Conduit Silver **GR** Grey **BL** Black **BZ** Bronze **PR** Primer Finish **AC** Clear Matte Anodized **WH** White **BL** Black **GR** Grey **BZ** Bronze **AB** Piano Gloss Black **WH** White **GR** Grey **BL** Black **BZ** Bronze **RAL** Custom Color Specify RAL # *Leave blank for Trimless	**FT** Flat Housing New Construction (1, 2) **FTIC** Flat Housing IC-Rated (up to 15W maximum) (1, 2) **FTA** Flat Adjustable Housing **NC1** New Construction All-in-One **NCCP** Chicago Plenum **NCIC** Insulation Contact Rated / Airtight	**UNV** 120V-277V	***For use with Universal Voltage 120V - 277V*** *No Additional Charge* **D22** ERP 0-10V, 1% (2) **D6E** EldoLED 0-10V, 1% (4) **D6F** EldoLED 0-10V, 1% (4) **D4A** Lutron ECO, 0.1% (1, 2, 4) **D4E** Lutron 5 ECO, 5% (1, 2, 3, 4) **D4H** Lutron H ECO, 1% Fade (1, 2, 3, 4) **D4P** Lutron ECO, 1% (4) **D6A** EldoLED 0-10V, 0.1% (4) **D6B** EldoLED 0-10V, 0.1% (4) **D7** EldoLED DALI, 0.1% (4) **D18** Moons' DMX, 0.1% (2, 3, 4, 8)	**CB27** 27" C-Channel Bars **CB32** 32" C-Channel Bars **CB52** 52" C-Channel Bars **CM27** 27" C-Channel Bars (use with FT or FTIC housings only) **CM52** 52" C-Channel Bars (use with FT or FTIC housings only) **EM** Emergency Battery (7) **EMW** Emergency Battery Wet Location (7) * Residential grade nailer bars provided standard
	Warm Glow Dimming **15WG2** 15W LED **20WG2** 20W LED	**2722KS** 2700K-2200K, 80+ CRI **2722KH** 2700K-2200K, 90+ CRI **3022KS** 3000K-2200K, 80+ CRI **3022KH** 3000K-2200K, 90+ CRI **3522KS** 3500K-2200K, 80+ CRI					**120V**	***For use with 120V only*** *No Additional Charge* **D19** Phase 2-wire, 1% (1, 2) **D22** ERP Phase 2-wire, 1% (2) **D3** Lutron 2-wire, 1% (4, 6)	
	Color Select Tunable White **12CS1** 12W LED **18CS1** 18W LED (5)	**6022KS** 6000K-2200K, Tunable White Light 80+ CRI					**347V**	***For use with 347V only*** **D15** 0-10V dim, 1% 347V only (1, 2, 3, 4)	

Notes:
1 Not available for Warm Glow.
2 Not available for Color Select
3 Not available with 9W
4 Not available with FT or FTIC housing
5 Not available with NCIC housing
6 Use only up to 15W max with NCIC housing
7 Not available with 347V. NC1 housing only. Requires above ceiling access for service
8 Not available in trimless and millwork

TRIM FINISH OPTIONS

White | Grey | Black | Bronze | Custom RAL (example) | Custom RAL (example)

Custom colors and primer finish also available

USAI LIGHTING COLLABORATORY
13 Crosby Street
New York, NY 10013
845-234-4090
showroom@usailighting.com

USAI LIGHTING HEADQUARTERS
1126 River Road
New Windsor, NY 12553
T: 845–565–8500 F: 845–561–1130
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BeveLED Mini® Complete - B3RW
3″ Round Wall Wash with Remote Driver

USAI® Lighting

1. Specify fixture part number. (All boxes must be filled in to correctly order)

B3RW__			W2-D1				RM	
BeveLED Trim Style	**Wattage Options**	**LED Color Options**	**Beam Options**	**Bevel Trim Finish Options**	***Flange/ Millwork Collar Finish**	**Housing Options**	**Remote Dimming Driver**	**Acessories (Optional)***
F Trimmed with Flange (use with all materials) **L** Trimless Spackle-in (use with sheetrock and plaster only) **M** Millwork Knife-Edge (use with wood and stone)	**Classic White Light** **09X3** 9W LED **15X3** 15W LED **20X3** 20W LED	**27KS** 2700K, 80+ CRI **27KH** 2700K, 90+ CRI **27KU** 2700K, 95+ CRI **30KS** 3000K, 80+ CRI **30KH** 3000K, 90+ CRI **30KU** 3000K, 95+ CRI **35KS** 3500K, 80+ CRI **35KH** 3500K, 90+ CRI **35KU** 3500K, 95+ CRI **40KS** 4000K, 80+ CRI **40KH** 4000K, 90+ CRI **40KU** 4000K, 95+ CRI	**W2-D1** Horizontal Wall Wash Optic	**WH** White **SC** Conduit Silver **GR** Grey **BL** Black **BZ** Bronze **PR** Primer Finish **AC** Clear Matte Anodized **AB** Piano Gloss Black **RAL** Custom Color Specify RAL #	**WH** White **SC** Conduit Silver **GR** Grey **BL** Black **BZ** Bronze **PR** Primer Finish **AC** Clear Matte Anodized **WH** White **BL** Black **GR** Grey **BZ** Bronze **AB** Piano Gloss Black **WH** White **GR** Grey **BL** Black **BZ** Bronze **RAL** Custom Color Specify RAL # *Leave blank for Trimless	**FT** Flat Housing New Construction **FTIC** Flat Housing IC-Rated (up to 15W maximum) **FTA** Flat Adjustable Housing **NC1** New Construction All-in-One **NCCP** Chicago Plenum **NCIC** Insulation Contact Rated / Airtight	**RM** Remote Dimming Driver, specify remote power supply in table below	**CB27** 27" C-Channel Bars **CB32** 32" C-Channel Bars **CB52** 52" C-Channel Bars **CM27** 27" C-Channel Bars (use with FT or FTIC housing only) **CM52** 52" C-Channel Bars (use with FT or FTIC housing only) * Residential grade nailer bars provided standard
	Warm Glow Dimming **15WG2** 15W LED **20WG2** 20W LED	**2722KS** 2700K-2200K, 80+ CRI **2722KH** 2700K-2200K, 90+ CRI **3022KS** 3000K-2200K, 80+ CRI **3022KH** 3000K-2200K, 90+ CRI **3522KS** 3500K-2200K, 80+ CRI						

USAI Power Supply Must Be Specified

2. Specify Remote Power Supply

RPB-01				
Remote Power Supply	**Wattage Options**	**Voltage**	**Remote Dimming Type and Level**	**Remote Emergency Option**
RPB-01 BeveLED Mini Remote Power Supply	**Classic White** **09X3** 9W LED **15X3** 15W LED **20X3** 20W LED **Warm Glow** **15WG2** 15W LED **20WG2** 20W LED	**UNV** 120V - 277V **120V** 120V Only	**D4A** Lutron ECO, 0.1% (1) **D4E** Lutron 5 ECO, 5% (1, 2) **D4H** Lutron H ECO, 1% Fade (1, 2) **D4P** Lutron ECO, 1% **D6A** EldoLED 0-10V, 0.1% **D6B** EldoLED 0-10V, 0.1% **D6E** EldoLED 0-10V, 1% **D6F** EldoLED 0-10V, 1% **D7** EldoLED DALI, 0.1% **D18** Moons DMX, 0.1% (2) **D3** Lutron 2-wire, 1% **D19** Hatch Phase 2-wire, 1% (1) *1 Not available for Warm Glow 2 Not available for 9W*	**EM7** EM battery requires remote enclosure by others, minimum size 14.5" L x 6.5" W x 3" H

NOTE:
Remote Power Supplies Require Enclosures by Others.
See Page 6 for Details.

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13 Crosby Street
New York, NY 10013
845-234-4090
showroom@usailighting.com

USAI LIGHTING HEADQUARTERS
1126 River Road
New Windsor, NY 12553
T: 845–565–8500 F: 845–561–1130
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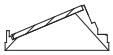
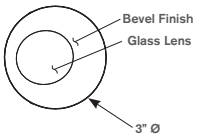
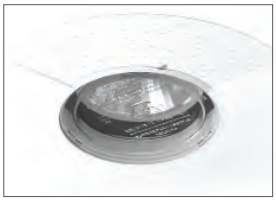
Trimless - B3RWL

TRIM DETAILS

Trimless - B3RWL



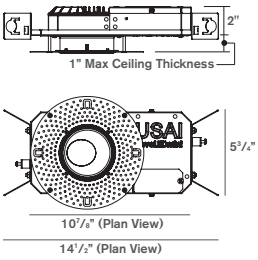




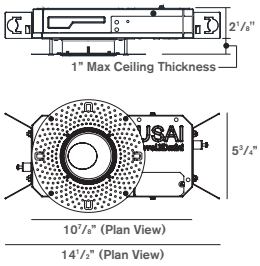
Clear acrylic overspray protector provided standard with every housing to keep out dust and contaminants during construction. Allows for use as work light.

HOUSING OPTIONS

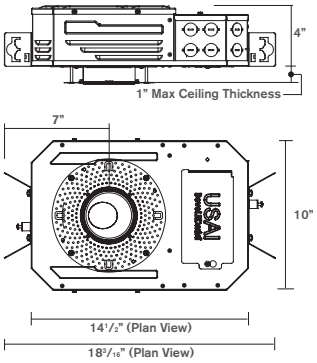
Flat Housing - FT



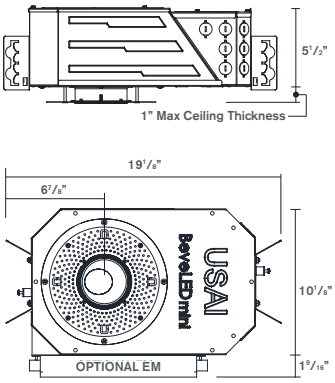
Flat Housing, IC-Rated - FTIC
(up to 15W maximum)



Flat Adjustable Housing - FTA



New Construction Housing - NC1
Insulation-Contact Rated - NCIC
Chicago Plenum Rated - NCCP



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New York, NY 10013
845-234-4090
showroom@usailighting.com

USAI LIGHTING HEADQUARTERS
1126 River Road
New Windsor, NY 12553
T: 845–565–8500 F: 845–561–1130
info@usailighting.com

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R4 - DMX

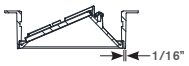
Cut sheet 4 of 9

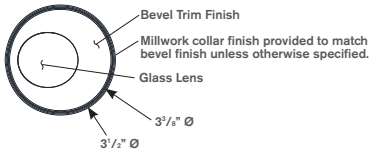
USAI® Lighting

Millwork - B3RWM

TRIM DETAILS

Millwork - B3RWM

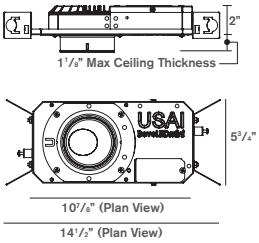




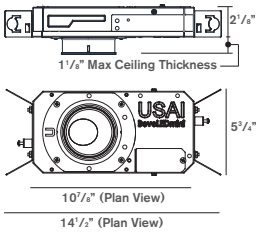
Clear acrylic overspray protector provided standard with every housing to keep out dust and contaminants during construction. Allows for use as work light.

HOUSING OPTIONS

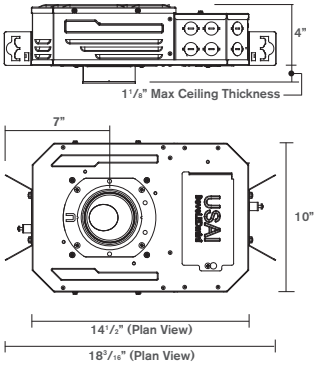
Flat Housing - FT



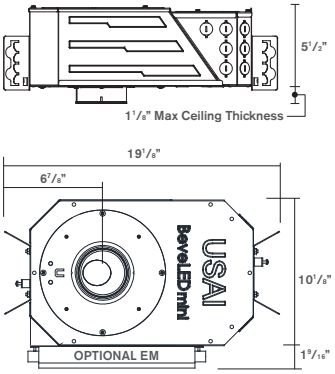
Flat Housing, IC-Rated - FTIC
(up to 15W maximum)



Flat Adjustable Housing - FTA



New Construction Housing - NC1
Insulation-Contact Rated - NCIC
Chicago Plenum Rated - NCCP



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Cut sheet 5 of 9

BeveLED Mini® Complete - B3RW
3″ Round Wall Wash

USAI® Lighting

BEVELED MINI SPECIFICATIONS

FIELD REPLACEABLE LED LIGHT ENGINE
is serviceable through the aperture with a Phillips screwdriver. All USAI Lighting light engines feature industry-leading color consistency.

FIELD REPLACEABLE INTEGRAL DRIVER
Unless otherwise specified, a 0-10V, 100%-1% solid state electronic constant current integral D22 dimming driver with a high power factor is provided standard and sources 2mA. All integral dimming drivers are located within the fixture housing and are serviceable from below the ceiling through the aperture. Some on-time delay may be experienced depending on control system used. All dimming drivers comply with IEEE C62.41 surge protection.

INTEGRAL EMERGENCY BATTERY
An integral emergency battery pack is available as an option with the NC1 housing and integral driver/power supply only. IOTA emergency battery provides backup power for 90 minutes. NC1 fixtures are provided with an integral emergency battery that requires above ceiling access for service, and a remote test switch, which comes with a 24" lead length for location of the test switch. Remote EM test switch is dry/damp only; select EMW emergency option for a wet location-rated EM test switch. Fixtures that have no USAI EM option may be connected to an inverter (by others) for emergency lighting. Battery is not available with 347V.

Remote Emergency Test Switch included with NC1 housing and integral driver only. Above ceiling access required for service.

REMOTE LOCATION DRIVER
BeveLED Mini is available for use with remotely located driver. Driver is provided separately for remote location on site, enclosure to be provided by others. Remote dimming driver power supply option must be clearly specified in the "RP" table. Remote power supplies require enclosures by others that meet local codes and must be located in an accessible service panel within 100ft of the light fixture; see remote driver table below for coordination of enclosure sizes and wire gauges required. All dimming drivers comply with IEEE C62.41 surge protection.

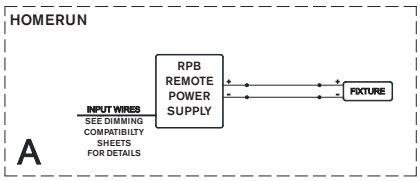
Remote Power Supply Requirements and Wiring Diagram
enclosure sizes and wire gauge with **1 fixture** per power supply.

Remote Power Supply	Dimming Option		Wire Gauge Required*	Minimum Enclosure Size Required (by others) RP Only	RP with EM Option**
RPB-01-09X3 RPB-01-15X3 RPB-01-20X3 RPB-01-15WG2 RPB-01-20WG2	**UNV-D4A**	Lutron ECO, 0.1% (1)	14/12	6.25" W x 4" L x 2" H	14.5" W x 6.5" L x 3" H
	UNV-D4E	Lutron 5 ECO, 5% (1, 2)			
	UNV-D4H	Lutron H ECO, 1% fade (1, 2)			
	UNV-D4P	Lutron ECO, 1%			
	UNV-D6A	EldoLED 0-10V, 0.1%	18/16		
	UNV-D6B	EldoLED 0-10V, 0.1%			
	UNV-D6E	EldoLED 0-10V, 1%			
	UNV-D6F	EldoLED 0-10V, 1%			
	UNV-D7	EldoLED DALI, 0.1%			
	UNV-D18	Moons DMX, 0.1% (2)			
	120V-D3	Lutron 2-wire phase, 1%	14/12	5.75" W X 2.625" L x 2" H	
	120V-D19	Hatch 2-wire phase, 1% (1)	14/12		

1 Not available for Warm Glow
2 Not available for 9W

Not all dimming options are availbale with all LED light engine options. See RP ordering table for details.
* Wire gauge 14/12 = Maximum distance from light fixture to remote power supply is 100' using 12 gauge wire, 50' using 14 gauge wire.
* Wire gauge 18/16 = Maximum distance from light fixture to remote power supply is 100' using 16 gauge wire, 50' using 18 gauge wire.
** Emergency battery remote power supplies cannot be located any more than 50 feet from light fixture.

Note: All light fixtures must be wired in homeruns per wiring diagram below.



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13 Crosby Street
New York, NY 10013
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showroom@usailighting.com

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1126 River Road
New Windsor, NY 12553
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info@usailighting.com

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Cut sheet 6 of 9

BeveLED Mini® Complete - B3RW
3″ Round Wall Wash

USAI® Lighting

BEVELED MINI SPECIFICATIONS

ADJUSTMENT
362° horizontal locking in 90° increments.

HOUSING
All BeveLED Mini fixtures are field-flexible which allows for field changes from trimless or millwork to trimmed with a simple components change with parts from USAI. Housings are fabricated of 20 ga. steel construction with thru wire J-box, 4 in 4 out at min. 90°C, #12 AWG thru branch circuit wiring. FTIC and NCIC housing for use with 9W, 12W and 15W light engines only are rated for direct contact with spray foam insulation of R-42 or less. FTIC housing is IC-rated up to 15W maximum.

MOUNTING
B3RWF overlap flange fixtures are designed for use in sheetrock, acoustical ceiling tile, and many other ceiling materials. B3RWL trimless fixtures are provided with a spackle collar and are designed for use in sheetrock/mud-in ceiling applications. B3RWM millwork fixtures are provided with a millwork collar and are designed for use in wood/millwork and stone construction applications. Butterfly brackets and residential grade adjustable nailer bars extendible from 14" to 24" centers with integral nails are provided standard for attachment to building structure. C-channel bars are optionally available for acoustical ceiling applications. If channel bars are specified for FT or FTIC housing, special reduced height channel bars (CM27 or CM52) will be provided.

Residential-grade nailer bars provided standard.

FIXTURE WEIGHT
FT and FTIC housings weigh 4 lbs. FTA housing weighs 10lbs. NC1, NCIC, and NCCP housings weigh 11 lbs. NC1 housing with EM weighs 14 lbs.

WARRANTY
Based on IESNA LM80-2008, BeveLED has a 50,000 hour rated life at 70% lumen maintenance (L70). USAI Lighting Warranty covers replacement parts for 5 years from date of shipment. Ambient temperatures at fixture location should not exceed 40°C during normal operation.

CEILING CUT OUT
B3RWF Trimmed with Overlap Flange: 3-5/8"Ø
B3RWL Trimless Spackle-in: 4-3/16"Ø
B3RWM Millwork Knife-edge: 3-9/16"Ø

LISTINGS
Dry/Damp/Wet location. AC and AB trim finishes are dry/damp only. EM test switch is dry/damp only. Select EMW option for wet location remote test switch. UL2043 rated for use in air handling plenums. NRTL/CSA-US tested to UL standards. IBEW union made.

NOTES
- Not for use in corrosive environment
- Use of pressure washer voids warranty

PHOTOMETRICS
Consult factory or website for IES files. Tested in accordance with IESNA LM79.

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showroom@usailighting.com

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New Windsor, NY 12553
T: 845–565–8500 F: 845–561–1130
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Type

R4 - DMX

Cut sheet 7 of 9

BeveLED Mini® Complete - B3RW
3″ Round Wall Wash

USAI® Lighting

BEVELED MINI SPECIFICATIONS

ADJUSTMENT
362° horizontal locking in 90° increments.

HOUSING
All BeveLED Mini fixtures are field-flexible which allows for field changes from trimless or millwork to trimmed with a simple components change with parts from USAI. Housings are fabricated of 20 ga. steel construction with thru wire J-box, 4 in 4 out at min. 90°C, #12 AWG thru branch circuit wiring. FTIC and NCIC housing for use with 9W, 12W and 15W light engines only are rated for direct contact with spray foam insulation of R-42 or less. FTIC housing is IC-rated up to 15W maximum.

MOUNTING
B3RWF overlap flange fixtures are designed for use in sheetrock, acoustical ceiling tile, and many other ceiling materials. B3RWL trimless fixtures are provided with a spackle collar and are designed for use in sheetrock/mud-in ceiling applications. B3RWM millwork fixtures are provided with a millwork collar and are designed for use in wood/millwork and stone construction applications. Butterfly brackets and residential grade adjustable nailer bars extendible from 14" to 24" centers with integral nails are provided standard for attachment to building structure. C-channel bars are optionally available for acoustical ceiling applications. If channel bars are specified for FT or FTIC housing, special reduced height channel bars (CM27 or CM52) will be provided.

Residential-grade nailer bars provided standard.

FIXTURE WEIGHT
FT and FTIC housings weigh 4 lbs. FTA housing weighs 10lbs. NC1, NCIC, and NCCP housings weigh 11 lbs. NC1 housing with EM weighs 14 lbs.

WARRANTY
Based on IESNA LM80-2008, BeveLED has a 50,000 hour rated life at 70% lumen maintenance (L70). USAI Lighting Warranty covers replacement parts for 5 years from date of shipment. Ambient temperatures at fixture location should not exceed 40°C during normal operation.

CEILING CUT OUT
B3RWF Trimmed with Overlap Flange: 3-5/8"Ø
B3RWL Trimless Spackle-in: 4-3/16"Ø
B3RWM Millwork Knife-edge: 3-9/16"Ø

LISTINGS
Dry/Damp/Wet location. AC and AB trim finishes are dry/damp only. EM test switch is dry/damp only. Select EMW option for wet location remote test switch. UL2043 rated for use in air handling plenums. NRTL/CSA-US tested to UL standards. IBEW union made.

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13 Crosby Street
New York, NY 10013
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USAI® Lighting

LED COLOR OPTIONS

Classic White Light

Our proprietary LED light engines achieve a 2-step MacAdam ellipse along the black body locus, resulting in reliable and uniform color from fixture to fixture. You'll see the results in consistently beautiful light throughout your space, whichever USAI LED product you specify.

Warm Glow® Dimming

Warm Glow Dimming provides warmth and glow once possible only in dimmed incandescent sources. Utilizing our patented proprietary algorithm and circuitry, Warm Glow Dimming technologies precisely mimic the black body curve of a standard 100W A19 lamp by gradually transitioning from 2700K , 3000K or 3500K down to 2200K. The result is virtually indistinguishable from an incandescent light source.

Color Select® Tunable White

Color Select represents the next innovation in color temperature control for advanced LED recessed downlighting. Color Select® products allow users to adjust color temperature from 6000K down to 2200K while independently adjusting intensity to achieve ultimate control over the quality of light in a space with a single fixture type. Color Select interfaces with standard dimming and control systems.

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showroom@usailighting.com

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1126 River Road
New Windsor, NY 12553
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CONFIGURABLE SPEC SHEETS COMING SOON

BeveLED® 2.2 Incline - B4RG
4.5″ Round Downlight for Sloped Ceilings

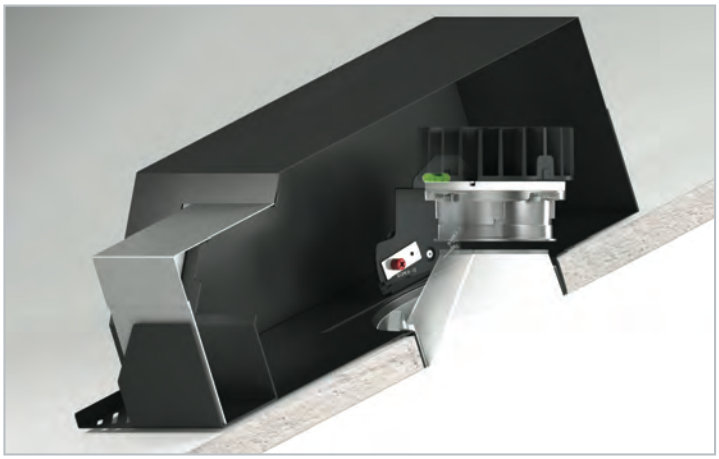
USAI® Lighting

Field Convertible from Trimless or Millwork to Trimmed

Trimmed - B4RGF

Trimless - B4RGL

Millwork - B4RGM



usailighting.com/slopedceiling

Introducing Beautiful, Precise Recessed Lighting for Sloped Ceiling Installations Up to 45 Degrees.

FEATURES

- Solutions for angles from 15° (3/12 pitch) to 45° (12/12 pitch)
- Perfect round and square roomside appearance
- Installations are always aligned with integral leveler
- Works with sheetrock, stone, plaster, and millwork ceilings
- Easily change from trimless or millwork to trimmed in the field
- Rated for direct contact with spray-foam insulation

SLOPED DOWNLIGHT PERFORMANCE DATA

DELIVERED* PERFORMANCE:	LED COLOR CHOICES									
	Classic White						Warm Glow Dimming		Color Select	
	9W	12W	16W	24W	33W	36W	16W	32W	16W	32W
Source Lumens:	1150	1300	1725	2400	3025	4150	1275	2150	1250	2075
Lumens Per Watt:	88	75	75	69	60	85	61	51	58	52
Delivered Lumens:	800	900	1200	1650	2075	2975	975	1625	925	1650

*Based on 3000K, 80+ CRI. Performance varies for each specific beamspread and color temperature. See IES files for exact values at usailighting.com.

CORRELATED COLOR TEMPERATURE MULTIPLIER	Classic White								Warm Glow Dimming				Color Select					
	2700K		3000K		3500K		4000K		2700K		3000K		2200K	2700K	3500K	4000K	5000K	6000K
Color Rendering Index:	80+	90+	80+	90+	80+	90+	80+	90+	80+	90+	80+	90+	80+	80+	80+	80+	80+	80+
Multiplier for Lumen Output:	0.94	0.78	1.00	0.78	1.00	1.00	1.06	1.06	0.94	0.74	1.00	0.80	0.87	0.96	1.04	1.09	1.13	1.18

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1126 River Road
New Windsor, NY 12553
T: 845–565–8500
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BeveLED® 2.2 Incline - B4RG
4.5″ Round Downlight for Sloped Ceilings

USAI® Lighting

Specify fixture part number. (All boxes must be filled in to correctly order)

B4RG__

BeveLED Trim Style

F Trimmed with Flange

L Trimless Spackle-in

M Millwork Knife-edge

Ceiling Slope

30 Angled trim accomodates ceiling slopes from 15° (3/12 pitch) to 30° (7/12 pitch) maximum

45 Angled trim accomodates ceiling slopes from 30° (7/12 pitch) to 45° (12/12 pitch) maximum

Wattage Options / LED Color Options / Beam Options

Classic White Light

Wattage Options	LED Color Options	Beam Options
09C3 9W LED	**27KS** 2700K, 80+ CRI	**25** 25° beam
12C3 12W LED	**27KH** 2700K, 90+ CRI	**40** 40° beam
16C3 16W LED	**30KS** 3000K, 80+ CRI	**70** 70° beam
24C3 24W LED	**30KH** 3000K, 90+ CRI	
33C3 33W LED (7)	**35KS** 3500K, 80+ CRI	
36E1 36W LED (7)	**35KH** 3500K, 90+ CRI	
	40KS 4000K, 80+ CRI	
	40KH 4000K, 90+ CRI	

Warm Glow Dimming

Wattage Options	LED Color Options	Beam Options
16WG2 16W LED	**2722KS** 2700K-2200K, 80+ CRI	**25** 25° beam
32WG2 32W LED (7)	**2722KH** 2700K-2200K, 90+ CRI	**40** 40° beam
	3022KS 3000K-2200K, 80+ CRI	**65** 65° beam
	3022KH 3000K-2200K, 90+ CRI	

Color Select Tunable White

Wattage Options	LED Color Options	Beam Options
16CS1 16W LED	**6022KS** 6000K-2200K, Tunable White Light 80+ CRI	**30** 30° beam
32CS1 32W LED (7)		**40** 40° beam
		50 50° beam

Lens Options

S Solite (provided standard)

SF Solite Frosted

BF Borosilicate Frosted

Bevel Trim Finish Options / *Flange/ Millwork Collar Finish

Bevel Trim Finish Options	*Flange/ Millwork Collar Finish
WH White	**WH** White
SC Conduit Silver	**SC** Conduit Silver
GR Grey	**GR** Grey
BL Black	**BL** Black
BZ Bronze	**BZ** Bronze
PR Primer Finish	**PR** Primer Finish
RAL Custom Color Specify RAL#	**RAL** Custom Color Specify RAL#

* Leave blank for trimless

Housing Options

NC New Construction

NCCP Chicago Plenum

NCIC Insulation Contact Rated / Airtight (24W Maximum) (1, 5)

Voltage Options
Select one

UNV 120V-277V

For use with Universal Voltage 120V - 277V

No Additional Charge

D6E EldoLED 0-10V, 1% (provided standard)

D6F EldoLED 0-10V, 1%

D4A Lutron ECO, 0.1% (1, 2, 3, 5, 6)

D4H Lutron H ECO, 1% Fade (2, 3, 4)

D4P Lutron ECO, 1% (1, 5, 6)

D6A EldoLED 0-10V, 0.1%

D6B EldoLED 0-10V, 0.1%

D7 EldoLED DALI, 0.1%

D28 EldoLED DMX, 0.1%

120V

For use with 120V only

No Additional Charge

D19 Phase 2-wire, 1% (1, 2, 3, 4, 5)

D3 Lutron 2-wire, 1%

347V

For use with 347V only

D15 0-10V dim, 1% 347V only (2, 3)

Dimming Driver Options

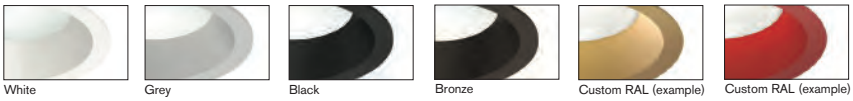
Accessories (Optional)*

EM Emergency Battery (8)

EMW Emergency Battery Wet Location (8)

Notes:
1 Not available with 36E1LED
2 Not available for Warm Glow
3 Not available for Color Select
4 Not available with 9W
5 Not available with 33W
6 For use with 16W and lower only
7 Not available with NCIC housing
8 Not available with 347V. For NC housings only

TRIM FINISH OPTIONS



White | Grey | Black | Bronze | Custom RAL (example) | Custom RAL (example)

Custom colors and primer finish also available

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Type

R5 - DMX

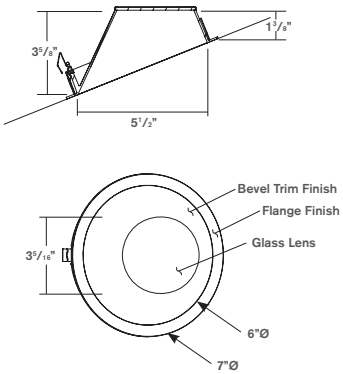
Cut sheet 2 of 20

USAI® Lighting

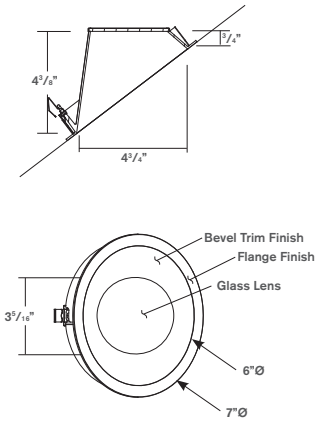
Trimmed - B4RGF

TRIM DETAILS

For 15° (3/12) - 30° (7/12) Slope Ceilings



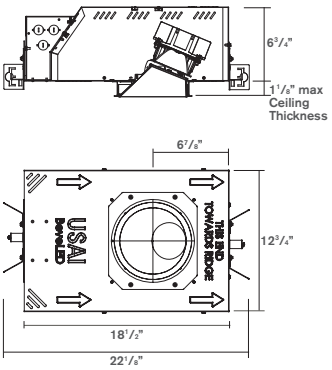
For 30° (7/12) - 45° (12/12) Slope Ceilings



HOUSING OPTIONS

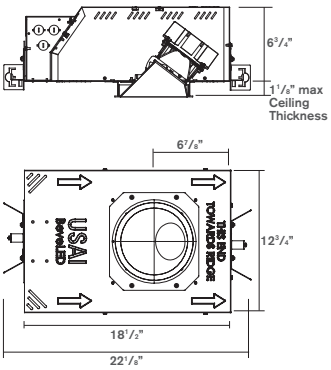
For 15° (3/12) - 30° (7/12) Slope Ceilings

New Construction - NC
Chicago Plenum - NCCP
Insulated Contact Rated / Airtight - NCIC



For 30° (7/12) - 45° (12/12) Slope Ceilings

New Construction - NC
Chicago Plenum - NCCP
Insulated Contact Rated / Airtight - NCIC



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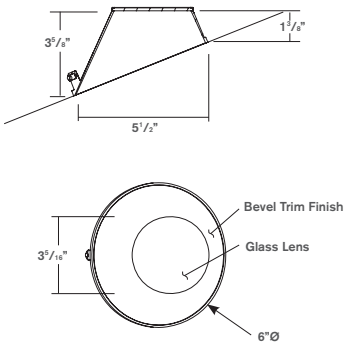
Cut sheet 3 of 20

USAI® Lighting

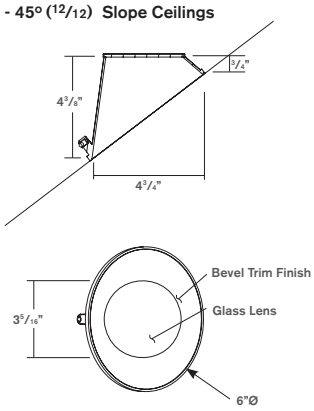
Trimless - B4RGL

TRIM DETAILS

For 15° (3/12) - 30° (7/12) Slope Ceilings



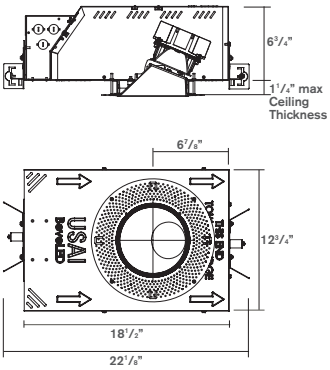
For 30° (7/12) - 45° (12/12) Slope Ceilings



HOUSING OPTIONS

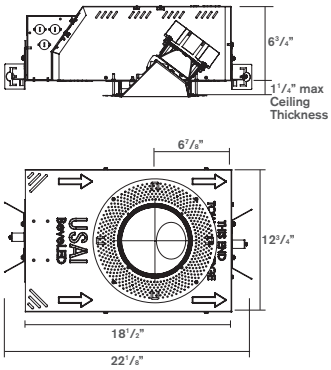
For 15° (3/12) - 30° (7/12) Slope Ceilings

New Construction - NC
Chicago Plenum - NCCP
Insulated Contact Rated / Airtight - NCIC



For 30° (7/12) - 45° (12/12) Slope Ceilings

New Construction - NC
Chicago Plenum - NCCP
Insulated Contact Rated / Airtight - NCIC



USAI LIGHTING COLLABORATORY
13 Crosby Street
New York, NY 10013
845–234–4090
showroom@usailighting.com

USAI LIGHTING HEADQUARTERS
1126 River Road
New Windsor, NY 12553
T: 845–565–8500
info@usailighting.com

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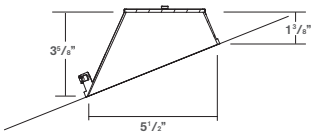
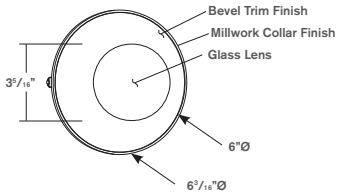
USAI® Lighting

Millwork - B4RGM

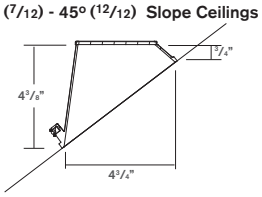
TRIM DETAILS

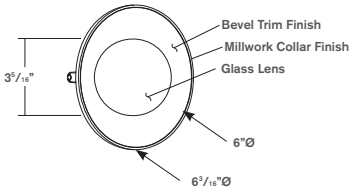
For 15º (3/12) - 30º (7/12) Slope Ceilings





For 30º (7/12) - 45º (12/12) Slope Ceilings

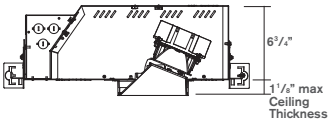


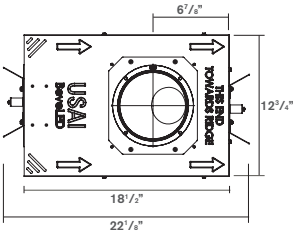


HOUSING OPTIONS

For 15º (3/12) - 30º (7/12) Slope Ceilings

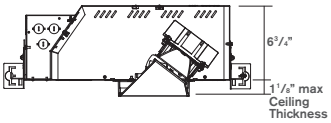
New Construction - NC
Chicago Plenum - NCCP
Insulated Contact Rated / Airtight - NCIC

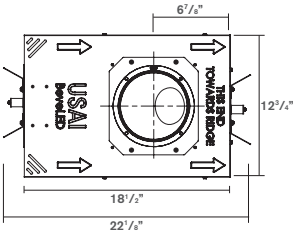




For 30º (7/12) - 45º (12/12) Slope Ceilings

New Construction - NC
Chicago Plenum - NCCP
Insulated Contact Rated / Airtight - NCIC





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New York, NY 10013
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showroom@usailighting.com

USAI LIGHTING HEADQUARTERS
1126 River Road
New Windsor, NY 12553
T: 845–565–8500
info@usailighting.com

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USAI® Lighting

BEVELED 2.2 INCLINE SPECIFICATIONS

FIELD REPLACEABLE LED LIGHT ENGINE
is serviceable through the aperture without tools or with a Philips screwdriver. All USAI Lighting light engines feature industry-leading color consistency.

FIELD REPLACEABLE DRIVER
Unless otherwise specified, a 0-10V, 100%-1% solid state electronic constant current integral D6E dimming driver with a high power factor is provided standard and sources 2mA. All integral dimming drivers are located within the fixture housing and are serviceable from below the ceiling through the aperture. Some on-time delay may be experienced depending on control system used. All dimming drivers comply with IEEE C62.41 surge protection.

EMERGENCY BATTERY
IOTA emergency battery provides backup power for 90 minutes. NC EM fixtures are provided with an integral emergency battery which can be serviced through the aperture from below the ceiling plane, and a remote test switch, which comes with a 24" lead length for location of the test switch. Remote EM test switch is dry/damp only; select EMW emergency option for a wet location-rated EM test switch. Fixtures that have no USAI EM option may be connected to an inverter (by others) for emergency lighting. Battery is not available with 347V.

Remote Emergency Test Switch included

ADJUSTMENT
Sloped ceiling housings are fitted with an integral bubble leveling device to ensure perfectly level installations and optical alignment. Optical assembly can be tilted and locked in position for ceiling slopes from 3/12 pitch to 12/12 pitch, which are visually indicated on tilt mechanism. Butterfly brackets are imprinted with ceiling thickness indexing allow installers to easily preset housing prior to installation: choose from ceiling thicknesses of ½", 5/8", ¾", 7/8", 1", or 1-1/8".

HOUSING
All BeveLED 2.2 fixtures are field-flexible which allows for field changes from trimless or millwork to trimmed with a simple components change with parts from USAI. Housings are fabricated of 20 ga. steel construction with thru wire J-box, 4 in 4 out at min. 90°C, #12 AWG thru branch circuit wiring. NCIC housing for use with 9W, 12W, and 16W light engines only are rated for direct contact with spray foam insulation of R-42 or less. NCIC housing is IC-rated up to 24W maximum.

MOUNTING
B4RGF overlap flange fixtures are designed for use in sheetrock, acoustical ceiling tile, and many other ceiling materials. B4RGL trimless fixtures are provided with a spackle collar and are designed for use in sheetrock/mud-in ceiling applications. B4RGM millwork fixtures are provided with a millwork collar and are designed for use in wood/millwork and stone construction applications. Butterfly brackets and adjustable channel bars extendible from 16" to 24" centers with integral nails are provided for attachment to building structure.

FIXTURE WEIGHT
NC, NCIC and NCCP housings weigh 16 lbs. NC housing with EM weighs 24.5 lbs.

WARRANTY
Based on IESNA LM80-2008, BeveLED has a 50,000 hour rated life at 70% lumen maintenance (L70). USAI Lighting Warranty covers replacement parts for 5 years from date of shipment. Ambient temperatures at fixture location should not exceed 40°C during normal operation.

CEILING CUT OUT
B4RGF Trimmed Overlap Flange: 6-5/8" Ø
B4RGL Trimless Spackle Frame: 7-1/8" Ø
B4RGM Millwork Knife Edge: 6-7/16" Ø

LISTINGS
Dry/Damp/Wet location. Remote EM test switch is dry/damp only. Select EMW option for wet location remote test switch. UL2043 rated for use in air handling plenums. NRTL/CSA-US tested to UL standards. IBEW union made.

NOTES
- Not for use in corrosive environment
- Use of pressure washer voids warranty

PHOTOMETRICS
Consult factory or website for IES files. Tested in accordance with IESNA LM79.

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New York, NY 10013
845–234–4090
showroom@usailighting.com

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1126 River Road
New Windsor, NY 12553
T: 845–565–8500
info@usailighting.com

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USAI® Lighting

LED COLOR OPTIONS

Classic White Light

Our proprietary LED light engines achieve a 2-step MacAdam ellipse along the black body locus, resulting in reliable and uniform color from fixture to fixture. You'll see the results in consistently beautiful light throughout your space, whichever USAI LED product you specify.


Warm Glow® Dimming

Warm Glow Dimming provides warmth and glow once possible only in dimmed incandescent sources. Utilizing our patented proprietary algorithm and circuitry, Warm Glow Dimming technologies precisely mimic the black body curve of a standard 100W A19 lamp by gradually transitioning from 2700K or 3000K down to 2200K. The result is virtually indistinguishable from an incandescent light source.


Color Select® Tunable White

Color Select represents the next innovation in color temperature control for advanced LED recessed downlighting. Color Select® products allow users to adjust color temperature from 6000K down to 2200K while independently adjusting intensity to achieve ultimate control over the quality of light in a space with a single fixture type. Color Select interfaces with standard dimming and control systems.


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New Windsor, NY 12553
T: 845–565–8500
info@usailighting.com

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D3 / DIML3

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

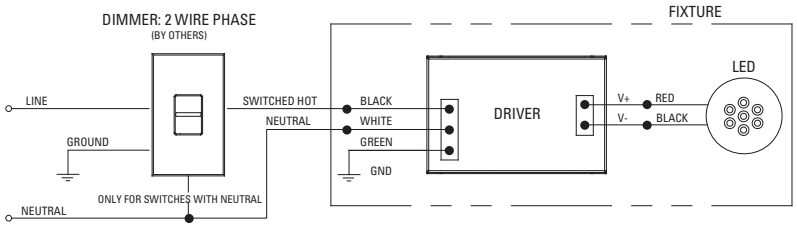
D3 / DIML3 LED: Lutron Hi-Lume A-Series 2 Wire Fwd Phase (with neutral) / LED Dimming Driver Wiring (Dims down to 1%) 120V

D3 / DIML3 Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Dimmer* Fixture Wattage	
120V Only				39W and Less	40W - 80W
ETC	Sensor+ Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
ETC	Unison DRd Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
Lutron	Maestro Wireless® 600W dimmer	MRF2-6ND-120-	100% - 1%	1 – 8	1 – 4
Lutron	Maestro Wireless® 1000W dimmer	MRF2-10ND-120-	100% - 1%	1 – 13	1 – 6
Lutron	HomeWorks® QS adaptive dimmer	HQRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 600W dimmer	HQRD-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 1000 W dimmer	HQRD-10ND-	100% - 1%	1 – 13	1 – 6
Lutron	Caseta Wireless® Pro 1000W dimmer	PD-10NXD-	100% - 1%	1 – 13	1 – 6
Lutron	Stanza® dimmer	SZ-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 adaptive dimmer	RRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 1000 W dimmer	RRD-10ND-	100% - 1%	1 – 6	1 – 3
Lutron	myRoom DIN power module	MQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® QS wallbox power module	HQRJ-WPM-6D-120-	100% - 1%	1 – 26	1 – 13
Lutron	Homeworks® DIN power module	LQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® wallbox power module	HWI-WPM-6D-120	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® QS control unit	QSGR-, QSGRJ-	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® 3000 control unit	GRX-3100-, GRX-3500-	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4U module	HW-RPM-4U-120, LP-RPM-4U-120	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4A module	HW-RPM-4A-120, LP-RPM-4A-120	100% - 1%	1 – 26	1 – 13
Lutron	GP dimming panels	Various	100% - 1%	1 – 26	1 – 13
Lutron	Ariadni CL 250W dimmer	AYCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Diva CL 250W dimmer	DVCL-253P-, DVSCCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Grafik T CL or RF CL dimmer	GT-250M-, GTJ-250M-	100%-1%	1 – 8	1 – 4
Lutron	Nova T CL 250W dimmer	NTCL-250-	100%-1%	1 – 10	1 – 5

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

D3 / DIML3
2 WIRE PHASE DIMMING



USAI Lighting

www.usailighting.com
info@usailighting.com

1126 River Road
New Windsor, NY 12553

T 845–565–8500
F 845–561–1130

I2-264-3 Revised 03/22/2017

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D4A / DIML4A and D4P / DIML4P

DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

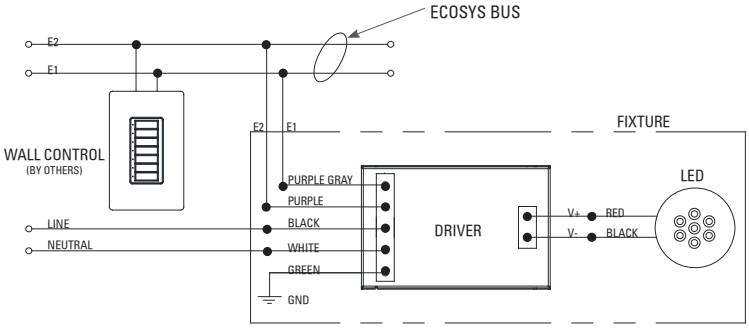
D4A / DIML4A LED: Lutron Hi-Lume Premier EcoSystem LED Driver (Dims down to 0.1%)
D4P / DIML4P LED: Lutron Hi-Lume Premier EcoSystem LED Driver (Dims down to 1%)

D4A / D4P EcoSystem Controls Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Maximum Quantity Light Fixtures Per Control
120V / 277V			
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	32
		FCJ/FCJS-ECO	3
120V ONLY			
Lutron	Energi Savr Node	QSN-1ECO-S	64
		QSN-2ECO-S	128
	GRAFIK Eye QS/ Homeworks QS control unit	QSGRJ-_E, QSGR-_E	64
	Quantum Hub	QP2-__2C	128
		QP2-__4C	256
		QP2-__6C	384
		QP2-__8C	512
	HomeWorks QS / myRoom Plus power module	LQSE-2ECO-D	128

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

D4A / DIML4A and D4P / DIML4P
EcoSystem CONTROLS



USAI Lighting
www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D4H /DIML4H

DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

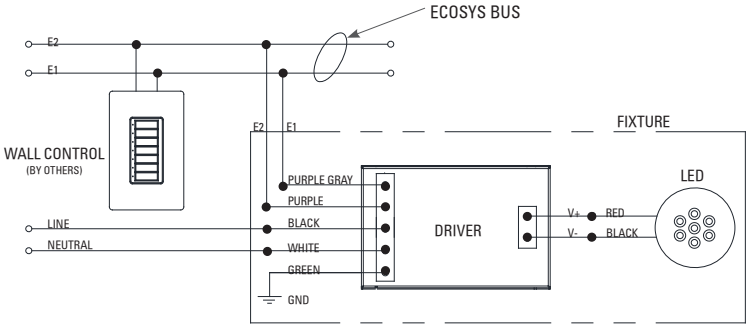
1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D4H / DIML4H LED: Lutron H Series EcoSystem LED Driver with Fade to Black (dims down to 1%)

D4H / DIML4H EcoSystem Dimmer Compatibility Chart					
Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V / 277V				39W and Less	40W - 80W
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	100%–1%	1–32	1 – 16
Lutron	Energi Savr Node	QSN-1ECO-S, QSN-2ECO-S	100%–1%	1–64	1 – 32
Lutron	GRAFIK Eye QS (120V ONLY)	QSGRJ- E, QSGR- E	100%–1%	1–64	1 – 32
Lutron	Quantum	Various	100%–1%	1–64	1 – 32

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

D4H / DIML 4H
EcoSystem CONTROLS



USAI Lighting
www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D6A / DIML6A and D6E / DIML6E
D6B / DIML6B and D6F / DIML6F

IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
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3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D6A / DIML6A and D6E / DIML6E LED Dimming Compatibility Table

D6A / DIML6A and D6E / DIML6E are linearly programmed dimming drivers for use with the dimming controls listed in the table below.
D6A / DIML6A = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1%
D6E / DIML6E = EldoLED ECOdrive 0-10V control dims from 100% to 1%

D6A / DIML6A and D6E / DIML6E Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range			Qty Fixtures Per Dimmer*
120V & 277V			DIML6A		6E	Refer to manufacturer's dimmer load rating for maximum and minimum fixture quantities per dimmer. Enlighted compatible.
Lutron	Diva	DVTV/NFTV with PP-20	99% -	0.1%	1%	
Lutron	Nova T	NTFTV with PP-20	99% -	0.1%	1%	
Lutron	Energi Savr Node	QSN-4T16-S	100% -	0.1%	1%	
Lutron	GP Dimming Panels	TVM2 Module	99% -	0.1%	1%	
Lutron	Interfaces	GRX-TVI w/ GRX3503	100% -	0.1%	1%	
Sensor Switch	nIO	nIO EZ	100% -	0.1%	1%	
enlighted	Control Unit	CU-3E-1R	100% -	0.1%	1%	

D6B / DIML6B and D6F / DIML6F LED Dimming Compatibility Table

D6B / DIML6B and D6F / DIML6F are logarithmic-programmed dimming drivers for use with the dimming controls listed in the table below.
D6B / DIML6B = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1% D6F / DIML6F = EldoLED ECOdrive 0-10V control dims from 100% to 1%

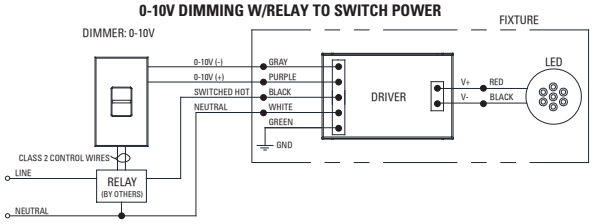
D6B / DIML6B and D6F / DIML6F Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range			Qty Fixtures Per Dimmer*
120V & 277V			DIML6B		6F	Refer to manufacturer's dimmer load rating for maximum and minimum fixture quantities per dimmer. Enlighted compatible.
Bush-Jaeger	Electronic potentiometer	2112U-101	100% -	0.1%	1%	
Jung	Electronic potentiometer	240-10	100% -	0.1%	1%	
Leviton	Iluma Tech dimmer	IP710-DLX	100% -	0.1%	1%	
Lightolier (Philips)	Momentum (120V ONLY)	ZP600FAM120	100% -	0.1%	1%	
Merten	Electronic potentiometer	5729	100% -	0.1%	1%	
Pass & Seymour	Titan	CD4FB-W	100% -	0.1%	1%	
Watt Stopper	Miro	DCLV1	100% -	0.1%	1%	
Synergy	Wallbox Dimmers	ISD BC	100% -	0.1%	1%	
ABB	i-bus	SD/S 2.16.1	100% -	0.1%	1%	
Crestron	Modules	GLX-DIMFLV8, GLXP-DIMFLV8	100% -	0.1%	1%	
Crestron	Green Light	GLPAC-DIMFLV4-, GLPAC-DIMFLV8-	100% -	0.1%	1%	
Crestron	Green Light Power Pack	GLPP-DIMFLVEX-PM, GLPP-1DIMFLV2EX-PM, GLPP-1DIMFLV3EX-PM	100% -	0.1%	1%	
Crestron	DIN Rail Analog Output Module	DIN-A08	100% -	0.1%	1%	
Crestron	DIN Rail 0-10V Fluorescent Dimmer	DIN-4DIMFLV4	100% -	0.1%	1%	
Crestron	iLux 0-10V Dimmer Expansion Module	CLS-EXP-DIMFLV	100% -	0.1%	1%	
enlighted	Control Unit	CU-3E-1R	100% -	0.1%	1%	

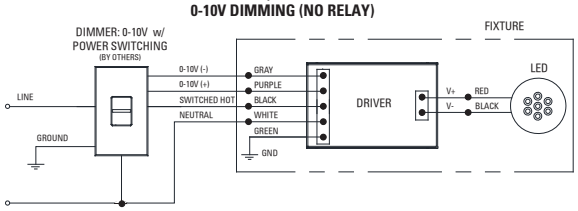
DIMMING DRIVER WIRING SCHEMES:

NOTES: Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

D6 / DIML6
0-10V DIMMING W/RELAY TO SWITCH POWER



D6 / DIML6
0-10V DIMMING (NO RELAY)



USAI Lighting
www.usailighting.com
info@usailighting.com
1126 River Road
New Windsor, NY 12553
T 845–565–8500
F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D7 / DIML7 and D7E

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

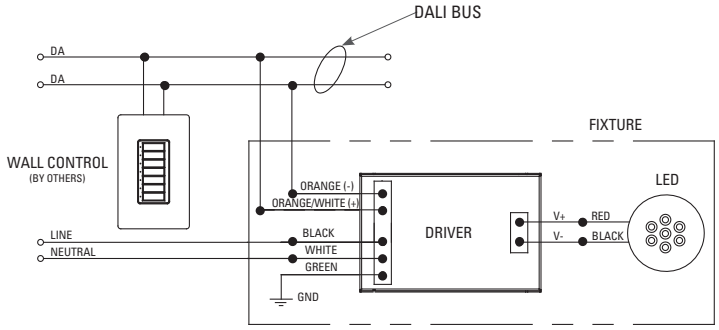
IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D7 / DIML7 and D7E Dimming Driver Wiring

D7 / DIML7 and D7E are linearly programmed dimming drivers.
D7 / DIML7 = EldoLED SOLOdrive DALI control dims from 100% to 0.1%
D7E = EldoLED ECOdrive DALI control dims from 100% to 1%

D7 / DIML7 / D7E
DALI CONTROLS



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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D15 / DIML15

DIMMING DRIVER WIRING SCHEMES:

NOTES:

Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS

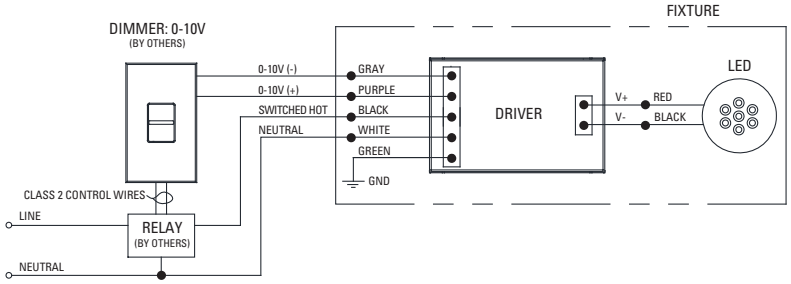
1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D15 / DIML15 LED: 0-10V, 347V Dimming Driver Wiring (Dims down to 1%) 347V Only

D15 / DIML15 Dimmer Compatibility Chart			
Manufacturer	Product	Dimmed Light Output Range	Qty Fixtures Per Dimmer*
347			Use source current per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
Acuity	Synergy ISD-BC	100% - 1%	
Douglas Lighting	WPN-5721, WPN-5822	100% - 1%	
Hubbell	Light Hawk2 LHD-IRS3-N347-xx	100% - 1%	
Leviton	Illumatech IP710-DLZ with 347V relay	100% - 1%	
Leviton	Centura Fluorescent Control System	100% - 1%	
Lutron	Nova NFTV-* dimmer plus 347V relay	100% - 1%	
Lutron	Diva DVTV-* dimmer plus 347V relay	100% - 1%	

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

D15 / DIML15
0-10V DIMMING W/RELAY TO SWITCH POWER



NOTE:
If switched, non-dimming operation is desired, cap off purple and gray wires individually at installation. Do NOT cap purple and gray wires together.

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info@usailighting.com
1126 River Road
New Windsor, NY 12553
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F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D19 / DIML19

DIMMING DRIVER WIRING SCHEMES:

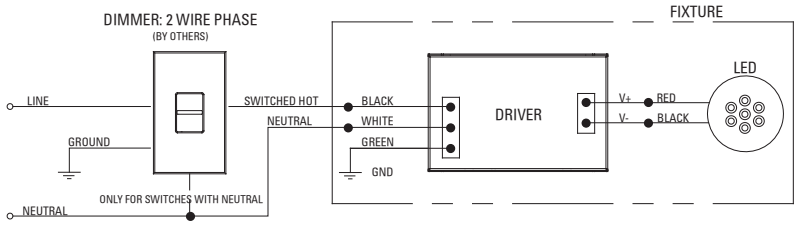
NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D19 / DIML19 LED: Hatch XTC series or equivalent - Forward and Reverse Phase Dimming Driver. Dims down to 1% contingent upon dimmer specification and load. 120V only.

D19 / DIML19
2 WIRE PHASE DIMMING



D19 / DIML19 Dimmer Compatibility Chart

120V ONLY		
Forward Phase / TRIAC Dimming		
Manufacturer	Product	Qty Fixtures Per Dimmer
Leviton	IPL06-10Z	Use fixture wattage per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
	6613-xxx	
Lutron	S-600P	
	S-603P	
	DVSC-603P	
	CT-600P	
	CT-603P	

120V ONLY		
Reverse Phase / ELV Dimming		
Manufacturer	Product	Qty Fixtures Per Dimmer
Leviton	6615	Use fixture wattage per fixture specification sheet to determine number of fixtures per dimmer. Max number of fixtures is limited by dimmer load rating.
	IPE04-xxx	
Lutron	NTELV-300	
	NTELV-600	
	SELV-300P	
	SELV-303P	
	DVELV-300P	
	DVELV-303P	

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info@usailighting.com
1126 River Road
New Windsor, NY 12553
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F 845–561–1130

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DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
D28

DIMMING DRIVER WIRING SCHEMES:

NOTES:
Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

IMPORTANT SAFETY INSTRUCTIONS
- SAVE THESE INSTRUCTIONS

1. Keep these instructions in a safe place for future reference.
2. Only qualified electricians in accordance to local codes should install these fixtures.
3. De-energize the electrical circuit at the circuit breaker prior to installation process or servicing.
4. Make sure all connections are in accordance with the National Electrical Code and any local regulations.
5. Cap any wires not used separately (not together).

D28 Dimming Driver Wiring

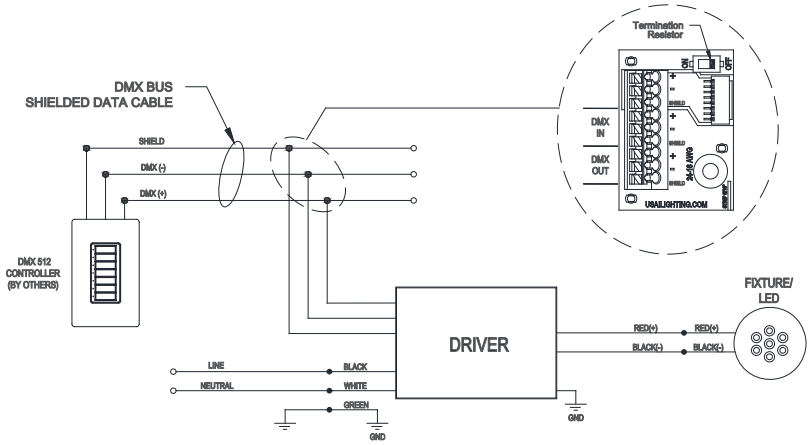
D28 are programmed dimming drivers.
D28 Eldo DMX control dims from 100% to 0.1%

DMX BUS -
SHIELDED DATA CABLE

The data cable used must meet the following requirements:
- type: shielded, 2-conductor twisted pair
- maximum capacitance between conductors: 30 pF/ft
- maximum capacitance between conductor and shield: 55 pF/ft
- maximum resistance: 0.02 ohms/ft
- normal impedance: 100-140 ohms
- conductive core: 24 AWG is recommended

If 3-wire data cables are preferred, we suggest a Belden 9841 or equivalent cable which meets the specifications for EIA RS-485 applications. Do not use standard microphone cables: they cannot transmit DMX512 data reliably over long distances. NOTE: DMX link termination device, provided through Dip Switch on connection board, should be used on last fixture in line on a circuit to avoid signal loss.

D28
DMX CONTROLS



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info@usailighting.com
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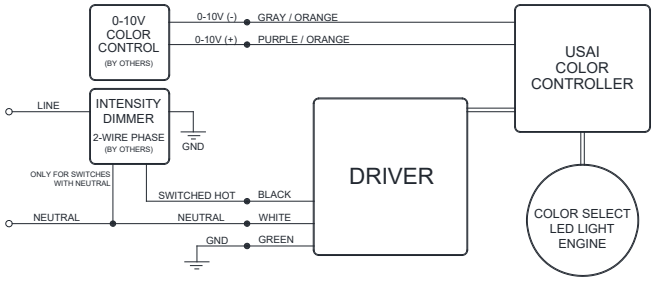
INTENSITY DIMMING DRIVER COMPATIBILITY SELECTION GUIDE DIML3

INTENSITY DIMMING DRIVER WIRING SCHEMES:

Note: Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

DIML3 LED: Lutron Hi-Lume A-Series 2 Wire Fwd Phase (with neutral) / LED Dimming Driver Wiring (Dims down to 1%) 120V only.



D3 / DIML3 Dimmer Compatibility Chart					
Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Dimmer* Fixture Wattage	
120V Only				39W and Less	40W - 80W
ETC	Sensor+ Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
ETC	Unison DRd Cabinet	ELV10	100% - 1%	1 – 26	1 – 13
Lutron	Maestro Wireless® 600W dimmer	MRF2-6ND-120-	100% - 1%	1 – 8	1 – 4
Lutron	Maestro Wireless® 1000W dimmer	MRF2-10ND-120-	100% - 1%	1 – 13	1 – 6
Lutron	HomeWorks® QS adaptive dimmer	HQRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 600W dimmer	HQRD-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	HomeWorks® QS 1000 W dimmer	HQRD-10ND-	100% - 1%	1 – 13	1 – 6
Lutron	Caseta Wireless® Pro 1000W dimmer	PD-10NXD-	100% - 1%	1 – 13	1 – 6
Lutron	Stanza® dimmer	SZ-6ND-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 adaptive dimmer	RRD-6NA-	100% - 1%	1 – 8	1 – 4
Lutron	RadioRA® 2 1000 W dimmer	RRD-10ND-	100% - 1%	1 – 6	1 – 3
Lutron	myRoom DIN power module	MQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® QS wallbox power module	HQRJ-WPM-6D-120-	100% - 1%	1 – 26	1 – 13
Lutron	Homeworks® DIN power module	LQSE-4A1-D	100% - 1%	1 – 6	1 – 3
Lutron	HomeWorks® wallbox power module	HWI-WPM-6D-120	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® QS control unit	QSGR-, QSGRJ-	100% - 1%	1 – 26	1 – 13
Lutron	GRAFIK Eye® 3000 control unit	GRX-3100-, GRX-3500-	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4U module	HW-RPM-4U-120, LP-RPM-4U-120	100% - 1%	1 – 26	1 – 13
Lutron	RPM-4A module	HW-RPM-4A-120, LP-RPM-4A-120	100% - 1%	1 – 26	1 – 13
Lutron	GP dimming panels	Various	100% - 1%	1 – 26	1 – 13
Lutron	Ariadni CL 250W dimmer	AYCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Diva CL 250W dimmer	DVCL-253P-, DVSCCL-253P-	100%-1%	1 – 8	1 – 4
Lutron	Grafik T CL or RF CL dimmer	GT-250M-, GTJ-250M-	100%-1%	1 – 8	1 – 4
Lutron	Nova T CL 250W dimmer	NTCL-250-	100%-1%	1 – 10	1 – 5

* NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

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info@usailighting.com

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INTENSITY DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
DIML4

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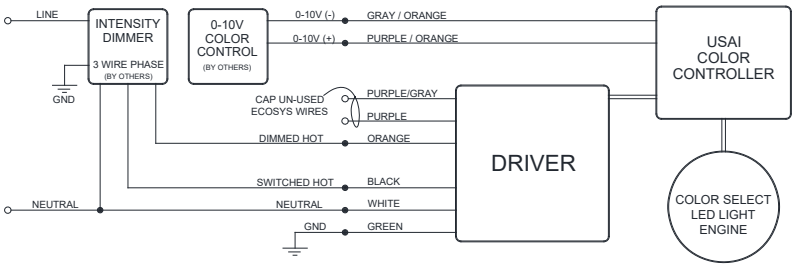
INTENSITY DIMMING DRIVER WIRING SCHEMES:

Note: Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

DIML4 LED: Lutron Hi-Lume A-Series LED Driver with Eco System Control / LED Dimming Driver Wiring (Dims down to 1%)



D4 / DIML4 LED: Lutron Hi-Lume A-Series LED Driver with 3-Wire FL Control / LED Dimming Driver Wiring (Dims down to 1%)

D4 / DIML4 3-Wire Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V Only				39W and Less	40W - 80W
ETC	Sensor+ Cabinet	D20 Dimming module	100% - 1%	1–53	1–26
ETC	Unison DRd Cabinet	D20F Dimming module	100% - 1%	1–53	1–26
Lutron	Nova T	NTF-10-	100%–1%	1–41	1 – 20
Lutron	Nova T	NTF-103P-	100%–1%	1–20	1 – 10
Lutron	Nova	NF-10-	100%–1%	1–41	1 – 20
Lutron	Nova	NF-103P-	100%–1%	1–20	1 – 10
Lutron	Vareo	VF-10-	100%–1%	1–20	1 – 10
Lutron	Skylark	SF-10P-, SF-103P-	100%–1%	1–20	1 – 10
Lutron	Diva	DVF-103P-, DVSCF-103P-	100%–1%	1–20	1 – 10
Lutron	Ariadni	AYF-103P-	100%–1%	1–20	1 – 10
Lutron	Vierti	VTF-6A-	100%–1%	1–15	1 – 7
Lutron	Maestro	MAF-6AM-, MSCF-6AM-	100%–1%	1–15	1 – 7
Lutron	Maestro Wireless	MRF2-F6AN-DV-	100%–1%	1–15	1 – 7
Lutron	RadioRA 2	RRD-F6AN-DV-	100%–1%	1–15	1 – 7
Lutron	HomeWorks QS	HQRD-F6AN-DV	100%–1%	1–15	1 – 7
Lutron	Interfaces	PHPM-3F-120, PHPM-3F-DV	100%–1%	1–41	1 – 20
Lutron	GP Dimming Panels	Various	100%–1%	1–41	1 – 20
277V Only				40W and Less	41W - 80W
ETC	Sensor+ Cabinet	D20 Dimming module	100% - 1%	1–53	1–26
ETC	Unison DRd Cabinet	D20F Dimming module	100% - 1%	1–53	1–26
Lutron	Nova T	NTF-10-277-	100%–1%	1–44	1 – 22
Lutron	Nova T	NTF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Nova	NF-10-277-	100%–1%	1–44	1 – 22
Lutron	Nova	NF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Skylark	SF-12P-277-, SF-12P-277-3	100%–1%	1–33	1 – 16
Lutron	Diva	DVF-103P-277-, DVSCF-103P-277-	100%–1%	1–33	1 – 16
Lutron	Ariadni	AYF-103P-277-	100%–1%	1–44	1 – 22
Lutron	Vierti	VTF-6A-	100%–1%	1–33	1 – 16
Lutron	Maestro	MAF-6AM-277-, MSCF-6AM-277-	100%–1%	1–20	1 – 10
Lutron	Maestro Wireless	MRF2-F6AN-DV-	100%–1%	1–33	1 – 16
Lutron	RadioRA 2	RRD-F6AN-DV-	100%–1%	1–33	1 – 16
Lutron	HomeWorks QS	HQRD-F6AN-DV	100%–1%	1–33	1 – 16
Lutron	Interfaces	PHPM-3F-DV	100%–1%	1–88	1 – 44
Lutron	GP Dimming Panels	Various	100%–1%	1–88	1 – 44

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

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www.usailighting.com
info@usailighting.com

1126 River Road
New Windsor, NY 12553

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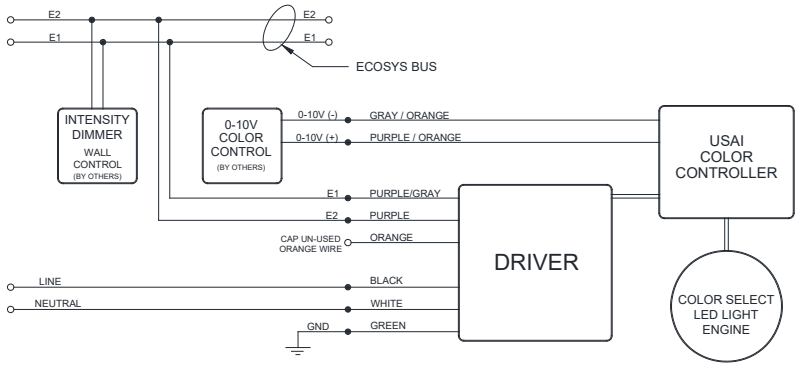
INTENSITY DIMMING DRIVER COMPATIBILITY SELECTION GUIDE

DIML4 Continued

INTENSITY DIMMING DRIVER WIRING SCHEMES:

Note: Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

DIML4 LED: Lutron Hi-Lume A-Series LED Driver with Eco System Control / LED Dimming Driver Wiring (Dims down to 1%)



D4 / DIML4 LED: Lutron Hi-Lume A-Series LED Driver with EcoSystem Control / LED Dimming Driver Wiring (Dims down to

D4 / DIML4 EcoSystem Dimmer Compatibility Chart					
Manufacturer	Product	Part Number	Dimmed Light Output Range	Qty Fixtures Per Control* Fixture Wattage	
120V / 277V				39W and Less	40W - 80W
Lutron	PowPak dimming module	RMJ-ECO32-DV-B	100%–1%	1–32	1 – 16
Lutron	Energi Savr Node	QSN-1ECO-S, QSN-2ECO-S	100%–1%	1–64	1 – 32
Lutron	GRAFIK Eye QS (120V ONLY)	QSGRJ- E, QSGR- E	100%–1%	1–64	1 – 32
Lutron	Quantum	Various	100%–1%	1–64	1 – 32

* NOTE: Number of fixtures may be higher if wattage is less than maximum values shown. Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

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info@usailighting.com
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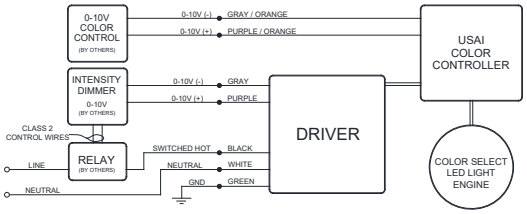
INTENSITY DIMMING DRIVER COMPATIBILITY SELECTION GUIDE
DIML6A & 6B
DIML6E & DIML6F

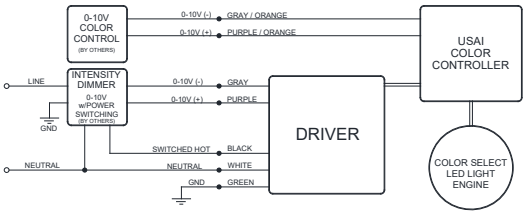
INTENSITY DIMMING DRIVER WIRING SCHEMES:

Note: Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

0-10V Dimming w/ Relay Switch to Power



0-10V Dimming



D6A / DIML6A and D6E / DIML6E LED Dimming Compatibility Table

D6A / DIML6A and D6E / DIML6E are linearly programmed dimming drivers for use with the dimming controls listed in the table below
D6A / DIML6A = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1%
D6E / DIML6E = EldoLED ECOdrive 0-10V control dims from 100% to 1%

D6A / DIML6A and D6E / DIML6E Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range		Qty Fixtures Per Dimmer*
120V & 277V			DIML6A	6E	Refer to manufacturer's dimmer load rating for maximum and minimum fixture quantities per dimmer. Enlighted compatible.
Lutron	Diva	DVTV/NFTV with PP-20	99% - 0.1%	1%	
Lutron	Nova T	NTFTV with PP-20	99% - 0.1%	1%	
Lutron	Energi Savr Node	QSN-4T16-S	100% - 0.1%	1%	
Lutron	GP Dimming Panels	TVM2 Module	99% - 0.1%	1%	
Lutron	Interfaces	GRX-TVI w/ GRX3503	100% - 0.1%	1%	
Sensor Switch	nIO	nIO EZ	100% - 0.1%	1%	
enlighted	Control Unit	CU-3E-1R	100% - 0.1%	1%	

D6B / DIML6B and D6F / DIML6F LED Dimming Compatibility Table

D6B / DIML6B and D6F / DIML6F are logarithmic-programmed dimming drivers for use with the dimming controls listed in the table below
D6B / DIML6B = EldoLED SOLOdrive 0-10V control dims from 100% to 0.1% D6F / DIML6F = EldoLED ECOdrive 0-10V control dims from 100% to 1%

D6B / DIML6B and D6F / DIML6F Dimmer Compatibility Chart

Manufacturer	Product	Part Number	Dimmed Light Output Range		Qty Fixtures Per Dimmer*
120V & 277V			DIML6B	6F	Refer to manufacturer's dimmer load rating for maximum and minimum fixture quantities per dimmer. Enlighted compatible.
Bush-Jaeger	Electronic potentiometer	2112U-101	100% - 0.1%	1%	
Jung	Electronic potentiometer	240-10	100% - 0.1%	1%	
Leviton	Illuma Tech dimmer	IP710-DLX	100% - 0.1%	1%	
Lightolier (Philips)	Momentum (120V ONLY)	ZP600FAM120	100% - 0.1%	1%	
Merten	Electronic potentiometer	5729	100% - 0.1%	1%	
Pass & Seymour	Titan	CD4FB-W	100% - 0.1%	1%	
Watt Stopper	Miro	DCLV1	100% - 0.1%	1%	
Synergy	Wallbox Dimmers	ISD BC	100% - 0.1%	1%	
ABB	i-bus	SD/S 2.16.1	100% - 0.1%	1%	
Crestron	Modules	GLX-DIMFLV8, GLXP-DIMFLV8	100% - 0.1%	1%	
Crestron	Green Light	GLPAC-DIMFLV4-, GLPAC-DIMFLV8-	100% - 0.1%	1%	
Crestron	Green Light Power Pack	GLPP-DIMFLVEX-PM, GLPP-1DIMFLV2EX-PM, GLPP-1DIMFLV3EX-PM	100% - 0.1%	1%	
Crestron	DIN Rail Analog Output Module	DIN-A08	100% - 0.1%	1%	
Crestron	DIN Rail 0-10V Fluorescent Dimmer	DIN-4DIMFLV4	100% - 0.1%	1%	
Crestron	iLux 0-10V Dimmer Expansion Module	CLS-EXP-DIMFLV	100% - 0.1%	1%	
enlighted	Control Unit	CU-3E-1R	100% - 0.1%	1%	

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info@usailighting.com

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USAI Lighting

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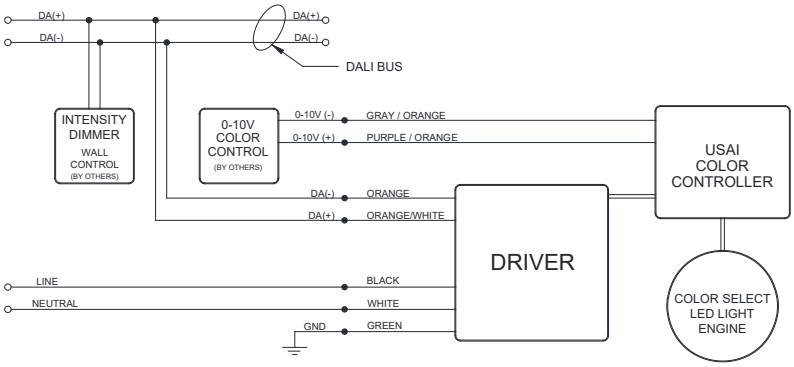
Covered By US Patents 8,581,520 and 8,456,109

INTENSITY DIMMING DRIVER WIRING SCHEMES:

Note: Wiring diagrams are examples of typical installations intended to illustrate the number of wires that must be run to fixture. These diagrams are not intended to specify all equipment necessary for a given dimming circuit. Refer to specific dimmer manufacturer's documentation for details.

DIML7 LED: eldoLED DALI dimming driver (dims down to 0.1%)



NOTE: Refer to dimmer manufacturer's documentation for installation instructions and circuit details.

USAI®

www.usailighting.com
info@usailighting.com

1126 River Road
New Windsor, NY 12553

T 845–565–8500
F 845–561–1130

I2-228-7 Revised 09/26/2018

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LITHONIA LIGHTING®

Catalog Number	
Notes	
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DIGITAL NAVIGATION

Ordering Tree nLight Platform Sensor Switch JOT Photometrics Performance Data

FEATURES & SPECIFICATIONS

INTENDED USE — The BLWP LED Wrap/ Wall bracket expands the BLT family with the features and aesthetics of the popular BLT and BLTR center basket design with a clean, versatile style and volumetric distribution. High efficacy LED light engines deliver energy savings and low maintenance compared to traditional sources. An extensive selection of configurations and options make the BLWP the perfect choice for many lighting applications including schools, offices, stairwells and other commercial spaces. With multiple mounting options, easy installation, and controls configurations, the BLWP is an excellent choice for renovation and new construction.

CONSTRUCTION — BLWP enclosure components are die-formed for dimensional consistency. For 2' and 4' product, hinged door frame allows easy access to electrical components and mounting locations without having to remove additional parts. For 8' product, suspension aircraft cables allow easy access to electrical components and mounting locations without having to remove additional parts. Available in three paint finishes: white (pre-paint), painted after fabrication white, and natural aluminum. Diffusers are extruded from impact modified acrylic for increased durability. Optional polycarbonate lens available for additional impact resistance, as well as Tamper Proof screws.

OPTICS — Volumetric illumination is achieved by creating an optimal mix of light to walls, partitions and vertical and horizontal work surfaces – rendering the interior space, objects and occupants in a more balanced, complimentary luminous environment. High performance extruded acrylic diffusers conceal LEDs and efficiently deliver light in a volumetric distribution. Five diffuser choices available - curved and square designs with ribbed, a smooth frosted finish, and a smooth polycarbonate finish.

ELECTRICAL — Long-life LEDs, coupled with high-efficiency drivers, provide superior quantity and qualityof illumination for extended service life. 80% LED lumen maintenance at 60,000 hours (L80/60,000). Replaces 2 lamp fluorescent.

Configurable BLWP: Available in High Efficiency (HE) versions for applications where a lower wattage (over the standard product) is required. The High Efficiency versions deliver >130 LPW and can be specified via the Lumen Package designations in the Ordering Information on page 2.

eldoLED driver options deliver choice of dimming range, and choices for control, while assuring flicker-free, low-current inrush, 89% efficiency and low EMI.

Optional integrated nLight® controls make each luminaire addressable - allowing it to digitally communicate with other nLight enabled controls such as dimmers, switches, occupancy sensors and photocontrols. Connection to nLight is simple. It can be accomplished with integrated nLight AIR wireless or through standard Cat-5 cabling. nLight offers unique plug-and-play convenience as devices and luminaires automatically discover each other and self-commission, while nLight AIR is commissioned easily through an intuitive mobile app.

Lumen Management: Unique lumen management system (option N80) provides on board intelligence that actively manages the LED light source so that constant lumen output is maintained over the system life, preventing the energy waste created by the traditional practice of over-lighting.

Driver disconnect provided where required to comply with US and Canadian codes.

CONTROLS — **Integrated sensor (individual control):** Sensor Switch MSD7ADCX (Passive infrared (PIR)) or MSDPDT7ADCX (PIR/Microphonics Dual Tech (PDT)) integrated occupancy sensor/automatic dimming photocell allows the luminaire to power off when the space is unoccupied or enough ambient light is entering the space.

Integrated Sensor (nLight Wired Networking): This sensor is nLight-enabled, meaning it has the ability to communicate over an nLight network. When wired, using CAT-5 cabling, with other nLight-enabled sensors, power packs, or WallPods, an nLight control zone is created. Once linked to a Gateway, directly or via a Bridge, the zone becomes capable of remote status monitoring and control via SensorView software. See page 5 for the nLight sensor options.

Integrated Smart Sensor (nLight AIR Wireless Platform): The rES7 sensor is nLight AIR enabled, meaning it has the ability to communicate over the wireless nLight control platform. It is available with an automatic dimming photocell, and either a digital PIR or dual technology occupancy sensor. It pairs to other luminairs and wall switches through our mobile app, CL***AIR***ITY PRO, which allows for simple sensor adjustment. See page 5 for more details on the Integrated Smart Sensor.

Integrated Wireless Sensor (single room control): Sensor Switch VERTEX JOT or JOTVTX15 luminaire-embedded occupancy and ambient light sensor allows the luminaire to power off when the space is unoccupied or when enough ambient light is entering the space. See page X for more details on the integrated wireless sensor.

INSTALLATION — Intended for surface or suspend mounting. For row mounting and quick mounting to junction boxes see accessories section. Suitable for damp location.

LISTINGS — CSA Certified to meet U.S. and Canadian standards.

DesignLights Consortium® (DLC) Premium qualified product. Not all versions of this product may be DLC Premium qualified. Please check the DLC Qualified Products List at www.designlights.org/QPL to confirm which versions are qualified.

BUY AMERICAN — Product with the BAA option is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT. Please refer to www.acuitybrands.com/buy-american for additional information.

WARRANTY — 5-year limited warranty. Complete warranty terms located at: www.acuitybrands.com/support/warranty/terms-and-conditions

Note: Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.

Low Profile LED Wraparound

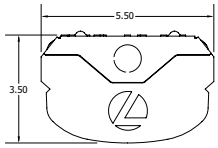
BLWP

2', 4' and 8' Lengths

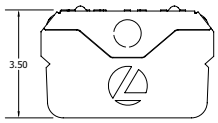
eldoLED your product | our drive · DLC PREMIUM · CSA+ CAPABLE · LED · nLIGHT · Buy American · JOT JUST ONE TOUCH

Specifications

2' Dimensions
Length: 24 (60.96)
Width: 5.50 (13.97)
Depth: 3.50 (8.89)



4' Dimensions
Length: 48 (121.92)
Width: 5.50 (13.97)
Depth: 3.50 (8.89)



8' Dimensions
Length: 96 (243.84)
Width: 5.50 (13.97)
Depth: 3.50 (8.89)

All dimensions are inches (centimeters) unless otherwise specified.

CSA+ Capable Luminaire

This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and out-of-the-box control compatibility with simple commissioning.

- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is part of an A+ Certified solution for nLight® or control networks marked by a shaded background*
- This luminaire is part of an A+ Certified solution for nLight control networks, providing advanced control functionality at the luminaire level, when selection includes driver and control options marked by a shaded background*

To learn more about A+, visit www.acuitybrands.com/aplus.

*See ordering tree for details

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A+ Capable options indicated by this color background.

ORDERING INFORMATION Lead times will vary depending on options selected. Consult with your sales representative.

Example: BLWP4 40L ADP GZ10 LP840

Series	Lumens ‡ Standard Efficiency (>100 LPW)		High Efficiency ‡ (>130 LPW)	
BLWP2 2' LED Wraparound	8L	800 Lumens	8LHE	800 Lumens
	20L	2000 Lumens	20LHE	2000 Lumens
	33L	3300 Lumens	33LHE	3300 Lumens
	40L	4000 Lumens	40LHE	4000 Lumens
	48L	4800 Lumens	48LHE	4800 Lumens
BLWP4 4' LED Wraparound	15L	1500 Lumens	15LHE	1500 Lumens
	20L	2000 Lumens	20LHE	2000 Lumens
	30L	3000 Lumens	30LHE	3000 Lumens
	40L	4000 Lumens	40LHE	4000 Lumens
	48L	4800 Lumens	48LHE	4800 Lumens
	60L	6000 Lumens	60LHE	6000 Lumens
	72L	7200 Lumens	72LHE	7200 Lumens
	85L	8500 Lumens	85LHE	8500 Lumens
	100L	10000 Lumens	100LHE	10000 Lumens
BLWP8 8' LED Wraparound	40L	4000 Lumens	40LHE	4000 Lumens
	60L	6000 Lumens	60LHE	6000 Lumens
	80L	8000 Lumens	80LHE	8000 Lumens
	100L	10000 Lumens	100LHE	10000 Lumens
	140L	14000 Lumens	140LHE	14000 Lumens
	180L	18000 Lumens	180LHE	18000 Lumens
	200L	20000 Lumens	200LHE	20000 Lumens

Lens/Diffuser	
ADP	Curved, ribbed
ADSM	Curved, smooth
SDP	Square, ribbed
SDSM	Square, smooth
PDSM	Curved, smooth polycarbonate ‡
Diffusers w/ trim rings	
ADPT	Curved, ribbed
ADSMT	Curved, smooth
SDPT	Square, ribbed
SDSMT	Square, smooth
PDSMT	Curved, smooth polycarbonate ‡

Driver	
(blank)	MVOLT
120	120V
277	277V
347	347V ‡

Driver	
EZ1	eldoLED dims to 1% (0-10v dimming)
GZ1	Generic dims to 1% (0-10v dimming) ‡
GZ10	Generic dims to 10% (0-10v dimming) ‡
SLD	Step-level dimming ‡

Color Temperature	
LP830	82CRI, 3000K
LP835	82CRI, 3500K
LP840	82CRI, 4000K
LP850	82CRI, 5000K
LP930	90CRI, 3000K
LP935	90CRI, 3500K
LP940	90CRI, 4000K
LP950	90CRI, 5000K

nLight Interface ‡

nLight Wired

(blank)	no nLight® interface
N80	nLight with 80% lumen management
N80EMG	nLight with 80% lumen management. For use with generator supply EM power ‡
N100	nLight without lumen management
N100EMG	nLight without lumen management. For use with generator supply EM power ‡

nLight Wireless

(blank)	no nLight® interface
NLTAIR2	nLight AIR Generation 2 enabled ‡

Control ‡

nLight Wired

(blank)	no nLight control
NES7	nLight™ nES 7 PIR integral occupancy sensor ‡
NESPDT7	nLight™ nES PDT 7 dual technology integral occupancy control ‡
NES7ADCX	nLight™ nES 7 ADCX PIR integral occupancy sensor with automatic dimming photocell ‡
NESPDT7ADCX	nLight™ nES PDT 7 dual technology integral occupancy sensor with automatic dimming photocell ‡

nLight Wireless

(blank)	no nLight control
RES7	nLight AIR PIR integral occupancy sensor with automatic dimming photocell for Networking Capabilities Individual Control ‡
RES7PDT	nLight AIR PIR integral occupancy sensor with automatic dimming photocell for Zone Control ‡
RIO	nLight AIR radio module without sensor ‡
RES7EM	nLight AIR PIR integral occupancy sensor with automatic dimming photocell and UL924 Emergency Operation, via power interrupt detection ‡
RES7PDTEM	nLight AIR microphonics dual technology occupancy sensor with automatic dimming photocell & UL924 Emergency Operation, via power interrupt detection ‡
RIOEM	nLight AIR radio module less sensor, with UL924 Emergency Operation, via power interrupt detection ‡

Individual Control

MSD7ADCX	PIR integral occupancy sensor with automatic dimming control photocell ‡
MSDPDT7ADCX	PDT integral occupancy sensor with with automatic dimming control photocell ‡
JOT	Wireless room control with "Just One Touch" pairing ‡
JOTVTX15	Wireless occupancy sensor with "Just One Touch" pairing ‡

Standby mode ‡

(blank)	Fixture with embedded sensor turns off when unoccupied
DIM10	Fixture with embedded sensor dims to approximately 10% light output when unoccupied ‡
DIM50	Fixture with embedded sensor dims to approximately 50% light output when unoccupied ‡
NOC	Occupancy sensor disabled ‡

Options

E10WLCP	EM Self-Diagnostic battery pack, 10W Constant Power, Certified in CA Title 20 MAEDBS
EL7L	700 nominal lumens battery pack ‡
EL14L	1400 nominal lumens battery pack ‡
BGTD	Bodine Generator Transfer Device ‡
USPOM	US Point of Manufacture
QMB	Quick Mount Bracket ‡
TRS	Tamper Resistant Screw ‡
GLR	Fast-blowing fuse ‡
GMF	Slow-blowing fuse ‡
FAO	Field Adjustable Output ‡
PLR___	Plug-in wiring, see page 8 for ordering information ‡
PLR1LVG	Plug-in wiring,low voltage dimming ‡
BAA	Buy America(n) Act Compliant

Finish

(blank)	Standard pre-paint white
PAF	Paint After Fabrication White
DNA	Paint After Fabrication Natural Aluminum

NOTE: ‡ indicates option value has ordering restrictions. Please reference the Option Value Ordering Restictions chart on the next page. Options are sorted alphanumerically.

See Stock configurations, Accessories and footnotes on page 4.

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‡ Option Value Ordering Restrictions	
Option value	**Restriction**
347	Not available with E10WLCP, EL7L, EL14L, BGTD or BLWP4 > 85L/ 85LHE.
BLWPCR, BLWPCRDNA, BLWP8CR, BLWP8CRDNA	Cannot be used to continuous row mount 4' fixtures with 8' fixtures.
BGTD	Not available with JOT sensor options or emergency battery options. Must specify voltage. Requires BSE labeling, voltage specific. Consult factory for options. Example: BGTD BSE10.
DIM10, DIM50	Not available with NLTAIR2 or JOT sensor option. Requires occupancy control. Must be ordered with nLight Wired or Individual Control sensor option.
EL7L, EL14L	Only available on BLWP8, 8ft length version of this fixture, in lumen packages 140L or less.
FAO	EZ1 driver required. Not available with USPOM, FAO or lumen packages > 6000LM. FAO is not available with other integrated controls options and restricts the use of external dimming controls. See chart on page 5 for additional details.
GLR, GMF	Must specify voltage. 120 or 277, with GLR and GMF fusing.
GZ1, GZ10	Not available with any Control or Sensor options except JOT & JOTVTX15
JOT, JOTVTX15	Not available with SLD, NLIGHT, NLTAIR2, NOC, USPOM or FAO. Available only on 4' versions with ADPT and ADMST trim options; not available with > 72L or 72LHE lumen packages.
Lumens	Approximate lumen output. For high Efficiency, all versions may not achieve 130+ LPW including 90CRI and versions with integral sensor trim. Refer to photometry on www.acuitybrands.com. See QPL for latest DLC listings.
MSD7ADCX, MSDPDT7ADCX	Must select Lens/Diffuser type with Trim Rings. Not available with nLight interface. 0-10V wires are not accessible via access plate.
N80EMG, N100EMG	Requires a connection to existing nLight network. Power is provided from a separate NLIGHT enabled fixture or external power pack.
NES7, NESPDT7, NES7ADCX, NESPDT7ADCX	Must select Lens/Diffuser type with Trim Rings. Requires N80, N80EMG, N100, or N100EMG. Only available with EZ1 driver.
NLTAIR2	Must select nLight wireless control. Not available with JOT or JOTVTX15
NOC	Not available with JOT sensor options. Can only be ordered in conjunction with EZ1, NLTAIR2, RES7/RES7PDT. Occupancy sensor disabled at factory but can be re-enabled upon commissioning.
PDSM, PDSMT	Not available with HE (high efficiency) performance package on BLWP2 and BLWP4 only.
PLR___, PLR1LVG	Not available with BLWP2. PLR1LVG is not available with Controls options or nLight interface.
QMB	Not available with BLWP2 (2') or BLWP8 (8') fixture.
RES7, RES7PDT, RIO, RES7EM, RES7PDTEM, RIOEM	Must select Lens/Diffuser type with Trim Rings. Requires EZ1 and NLTAIR2 to be specified. Only available with 60L or lower lumen packages on the BLWP4. Only available with 100LHE/80L lumen packages or lower on the BLWP8.
SLD	Not available with any nLight Interface or Control options. Cannot be used with PLR1LVG
TRS	Accessory BLWP TRS T15 BIT available to be ordered with this option. See Accessories section page 3. Order as separate item.

Non-Configurable BLWP:

Stock/MTO	Ci code	Catalog Description	UPC	Lumens	Wattage	LPW	Color Temperature	Voltage	Pallet QTY
MTO	*264V2M	BLWP2 20L ADP LP835	191848282045	1942	17	117	3500 K	120-277	80
	*264V2L	BLWP2 20L ADP LP840	191848282038	1973	17	119	4000 K	120-277	80
	*264CH0	BLWP2 33L ADP LP835	191848080825	3332	30	112	3500 K	120-277	80
	*264CH1	BLWP2 33L ADP LP840	191848080832	3345	30	112	4000 K	120-277	80
	*264CH2	BLWP2 40L ADP LP835	191848080849	3923	37	105	3500 K	120-277	80
	*264CH4	BLWP2 40L ADP LP840	191848080856	4117	37	110	4000 K	120-277	80
STOCK	*264V2K	BLWP4 30L ADP LP835	191848282021	3065	25	123	3500 K	120-277	70
	*264V2H	BLWP4 30L ADP LP840	191848281994	3114	25	125	4000 K	120-277	70
	*264CH5	BLWP4 40L ADP LP835	191848080863	4391	35	127	3500 K	120-277	70
	*264CH6	BLWP4 40L ADP LP840	191848080870	4263	35	123	4000 K	120-277	70
	*264CH7	BLWP4 48L ADP LP835	191848080900	5137	40	129	3500 K	120-277	70
	*264CH8	BLWP4 48L ADP LP840	191848080917	5205	40	131	4000 K	120-277	70

Accessories: *Order as separate catalog number.*

PART number	CI CODE	QTY	Description	Application
BLWP8/4CR	*272PFG	1	CONTINUOUS ROW MOUNT BRACKET FOR ROW CONNECTING BLWP4 and BLWP8 WHT	FOR USE TO MOUNT BLWP8 TO BLWP4, FOR STD FINISH AND PAF
BLWPCR	*250A0S	1	CONTINUOUS ROW MOUNT BRACKET WHT	FOR USE ON BLWP4 ONLY, FOR STD FINISH AND PAF ‡
BLWPCRDNA	*250A1S	1	CONTINUOUS ROW MOUNT BRACKET DNA	FOR USE ON BLWP4 ONLY, FOR DNA FINISH ‡
BLWP8CR	*2543C6	1	CONTINUOUS ROW MOUNT BRACKET WHT	FOR USE ON BLWP8 ONLY, FOR STD FINISH AND PAF ‡
BLWP8CRDNA	*2543CA	1	CONTINUOUS ROW MOUNT BRACKET DNA	FOR USE ON BLWP8 ONLY, FOR DNA FINISH ‡
BLWPCG36 F1	*264R3P	1	BLWPCG36 F1	ADJUSTABLE AIRCRAFT CABLE GRIPPER KIT, 36 INCH F1 CEILING TYPE
BLWPCG36 F2	*264R4G	1	BLWPCG36 F2	CABLE GRIPPER KIT, 36 INCH F2 CEILING TYPE
BLWPCG72 F1	*264R4H	1	BLWPCG72 F1	CABLE GRIPPER KIT, 72 INCH F1 CEILING TYPE
BLWPCG72 F2	*264R4M	1	BLWPCG72 F2	CABLE GRIPPER KIT, 72 INCH F2 CEILING TYPE
BLWPCGF36 F1	*264R4R	1	BLWPCGF36 F1	KIT WITH POWER FEED 36 INCH F1 CEILING TYPE
BLWPCGF36 F2	*264R4U	1	BLWPCGF36 F2	KIT WITH POWER FEED 36 INCH F2 CEILING TYPE
BLWPCGF72 F1	*264R4V	1	BLWPCGF72 F1	KIT WITH POWER FEED 72 INCH F1 CEILING TYPE
BLWPCGF72 F2	*264R4X	1	BLWPCGF72 F2	KIT WITH POWER FEED 72 INCH F2 CEILING TYPE
BLWPCGE36 F1	*264R50	1	BLWPCGE36 F1	KIT WITH EMERGENCY POWER FEED 36 INCH F1 CEILING TYPE
BLWPCGE36 F2	*264R5T	1	BLWPCGE36 F2	KIT WITH EMERGENCY POWER FEED 36 INCH F2 CEILING TYPE
BLWPCGE72 F1	*264R5V	1	BLWPCGE72 F1	KIT WITH EMERGENCY POWER FEED 72 INCH F1 CEILING TYPE
BLWPCGE72 F2	*264R53	1	BLWPCGE72 F2	KIT WITH EMERGENCY POWER FEED 72 INCH F2 CEILING TYPE
BLWPCGFD36 F1	*269V4M	1	BLWPCGFD36 F1	KIT WITH 0-10V DIMMING POWER FEED 36 INCH F1 CEILING TYPE
BLWPCGFD36 F2	*269V5C	1	BLWPCGFD36 F2	KIT WITH 0-10V DIMMING POWER FEED 36 INCH F2 CEILING TYPE
BLWPCGFD72 F1	*269V5N	1	BLWPCGFD72 F1	KIT WITH 0-10V DIMMING POWER FEED 72 INCH F1 CEILING TYPE
BLWPCGFD72 F2	*269V5X	1	BLWPCGFD72 F2	KIT WITH 0-10V DIMMING POWER FEED 72 INCH F2 CEILING TYPE
BLWP TRS T15 BIT	*2516KU	1	BLWP TRS T15 BIT	T15 WITH PIN, TORX BIT FOR TRS OPTION
BLWPQMB	*250A2S	1	BLWP Quick Mount Bracket	QUICK MOUNT BRACKET FOR INSTALLATION TO JUNCTION BOXES WITHOUT HAVING TO REMOVE ANY PARTS IN THE FIXTURE, 4FT FIXTURE ONLY.

nLight® Wired Control Accessories:
Order as separate catalog number. Visit www.acuitybrands.com/products/controls/nlight.

WallPod stations	Model number	Occupancy sensors	Model number
On/Off	nPODM [color]	Small motion 360°, ceiling (PIR / dual tech)	nCM 9 RJB / nCM PDT 9 RJB
On/Off & raise/lower	nPODM DX [color]	Large motion 360°, ceiling (PIR / dual tech)	nCM10 RJB / nCM PDT 10 RJB
Graphic touchscreen	nPOD GFX [color]	Wall switch with raise/lower	nWSX PDT LV DX [color]
Photocell controls	**Model number**	**Cat-5 cable (plenum rated)**	**Model number**
Full range dimming	nCM ADCX RJB	10' cable	CAT5 10FT J1
		30' cable	CAT5 30FT J1

nLight® AIR Control Accessories:
Order as separate catalog number. Visit www.acuitybrands.com/products/controls/nlightair.

Wall switches	Model number
On/Off single pole	rPODB [color] G2
On/Off two pole	rPODB 2P [color] G2
On/Off & raise/lower single pole	rPODB DX [color] G2
On/Off & raise/lower two pole	rPODB 2P DX [color] G2
On/Off & raise/lower single pole	rPODBZ DX WH G2

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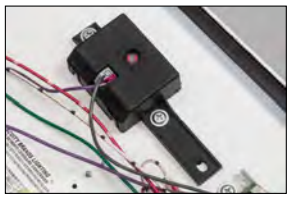
Replacement Parts: *Order as separate catalog number.*

2' Version Replacement Lens		4' Version Replacement Lens		8' Version Replacement Lens	
*264F5E	DBLWP24 ADP	*264F69	DBLWP48 ADP	*2543CE	DBLWP96 ADP
*264F5F	DBLWP24 SDP	*264F6E	DBLWP48 SDP	*2543CG	DBLWP96 SDP
*264F5H	DBLWP24 ADSM	*264F6F	DBLWP48 ADSM	*2543CJ	DBLWP96 ADSM
*264F5J	DBLWP24 SDSM	*264F6G	DBLWP48 SDSM	*2543CM	DBLWP96 SDSM
*264F5L	DBLWP24 ADPT	*264F6H	DBLWP48 ADPT	*2543CN	DBLWP96 ADPT
*264F5P	DBLWP24 SDPT	*264F6K	DBLWP48 SDPT	*2543CP	DBLWP96 SDPT
*264F5U	DBLWP24 ADSMT	*264F6L	DBLWP48 ADSMT	*2543CR	DBLWP96 ADSMT
*264F5W	DBLWP24 SDSMT	*264F6N	DBLWP48 SDSMT	*2543CS	DBLWP96 SDSMT
*264F66	DBLWP24 PDSM	*264F6W	DBLWP48 PDSM	*2543CW	DBLWP96 PDSM
*264F67	DBLWP24 PDSMT	*264F6X	DBLWP48 PDSMT	*2543CX	DBLWP96 PDSMT

FAO SETTINGS (Field Adjustable Output)

	0-10 Voltage Dimmer	% Lumen Output (approximate)	% Wattage (approximate)
Step 8	Full Output	100%	100%
Step 7	9.0 VDC	98%	100%
Step 6	8.0 VDC	88%	86%
Step 5	7.0 VDC	86%	82%
Step 4	6.0 VDC	82%	80%
Step 3	5.0 VDC	76%	75%
Step 2	4.0 VDC	71%	72%
Step 1	3.0 VDC	67%	71%

Simple adjustment of output through the use of a flat head screwdriver.



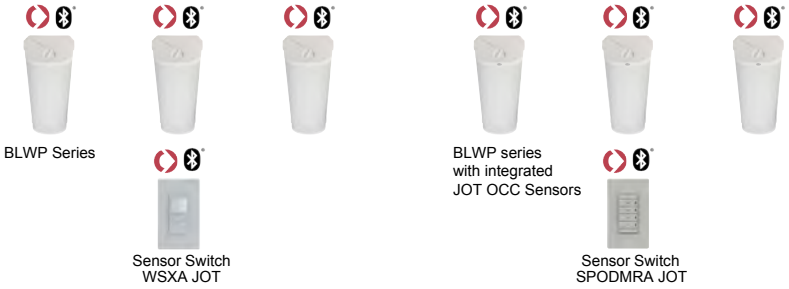
JOT Wireless

JOT
Just One Touch

Sensor Switch JOT Enabled Wireless Solution

Designed with contractors in mind, the Sensor Switch JOT enabled wireless solution offers a straightforward approach to the installation and pairing of lighting fixtures and controls. Absolutely no 0-10V control wires and no mobile apps are needed with JOT enabled products, allowing for lightning speed installation right out of the box.

1. **Power:** Install JOT enabled fixtures and controls as instructed.
2. **Pair:** Insert the pairing tool into the pinhole on the wall switch; press and hold any button for 6 seconds.
3. **Play:** Once paired, each fixture will individually dim down to 10% brightness. All products will be fully functional.



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nLight Platform

nLight embedded fixtures offer:	Customers get:
Manual Dimming	Convenience and visual comfort for occupants
Motion Sensing and/or Daylight Harvesting	Energy savings and code compliance
Fixture or Group Level Control	Ability to configure lighting to the space requirements
Flexibility	Ease of fixture moves, adds and changes
Wireless Wall Switch (nLight AIR Only)	Ease and flexibility of placement
Astronomical and Time of Day Scheduling	Energy savings and building security
Scalable Solution	nLight controls to grow with your business
Future-Ready	nLight platform to set foundation for future upgrades and capabilities

nLight Air Wireless

Simple as 1,2,3

1. Install the nLight® AIR fixtures with embedded smart sensor
2. Install the wireless battery-powered wall switch
3. With CL**AIR**ITY app, pair the fixtures with the wall switch and if desired, customize the sensor settings for the desired outcome

nLight Wired Networking

Simple as 1,2,3

1. Install the nLight® Wired fixtures with embedded control
2. Install the nLight Wired wall switch
3. Connect the fixtures using standard CAT5e cables and the devices will automatically discover each other and work (plug and play)

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Sensor Options					
Option	Automatic Dimming Photocell	Occupancy Sensing		nLight Wired Networking	nLight AIR Networking
		PIR	PDT		
MSD7ADCX	X	X			
MSDPDT7ADCX	X		X		
NES7		X		X	
NES7ADCX	X	X		X	
NESPDT7			X	X	
NESPDT7ADCX	X		X	X	
RES7	X	X			X
RES7PDT	X	X	X		X

Basic nLight Zone

Integrated Sensor with Individual Control

The MSD7ADCX PIR occupancy sensor/automatic dimming photocell is ideal for areas without obstructions and where daylight harvesting may be desired. Suggested applications include, but not limited to, hallways, corridors, storage rooms, and breakrooms or other areas where people are typically moving.

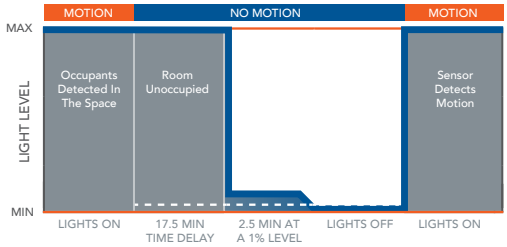
The MSDPDT7ADCX PIR/Microphonics Dual Tech occupancy sensor/automatic dimming photocell is ideal for areas with obstructions and where daylight harvesting is desired. Suggested applications include, but not limited to, open offices, private offices, classrooms, public restrooms, and conference rooms.

nLight Wired Networking

The nES 7 is ideal for small rooms without obstructions or areas with primarily walking motion. Ideal areas include hallways, corridors, storage rooms, and breakrooms. Additionally, the NES7ADCX includes an integrated photocell, which enables daylight harvesting controls.

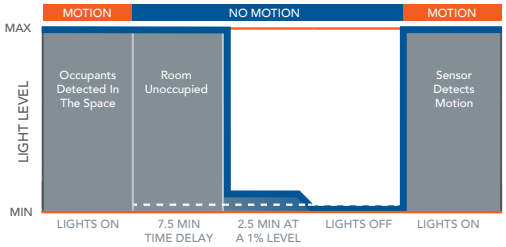
For areas like restrooms, private offices, open offices, conference rooms or any space with obstructions, the nES PDT 7 dual technology sensor is recommended. The nES PDT 7 utilizes both PIR (passive infrared) and Microphonics technologies to detect occupancy. Additionally, the NESPDT7ADCX includes an integrated photocell, which enables daylight harvesting controls which is ideal for areas where windows are present.

Sequence of Operation



*The presetting on the automatic dimming photocell is 5fc.

Sequence of Operation



*The presetting on the automatic dimming photocell is 5fc.

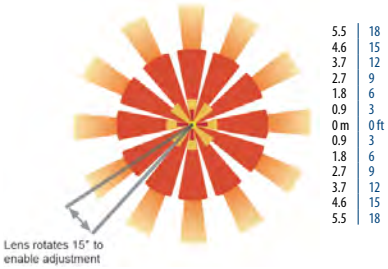
Sensor Coverage Pattern
Mini 360° Lens

- Recommended for walking motion detection from mounting heights between 8 ft (2.44 m) and 20 ft (6.10 m)
- Initial detection of walking motion along sensor axes at distances of 2x the mounting height up to 15 ft (4.57 m) and
- 1.75x up to 20 ft (6.10 m).
- Provides 12 ft (3.66 m) radial detection of small motion when mounted at 9 ft (2.74 m)
- Initial detection will occur earlier when walking across sensor's field of view than when walking directly at sensor

nLight AIR Wireless

nLight AIR is the ideal solution for retrofit or new construction spaces where adding additional wiring can be labor intensive and costly. nLight AIR is available with or without an integral sensor. The integrated rES 7 or rES7 PDT smart sensor is part of each luminaire in the nLight AIR network, which can be grouped to control multiple luminaires. The granularity of control with the digital PIR occupancy detection and daylight sensing makes a great solution for any application.

9 FT Mounting



Simple as 1,2,3

1. Install the nLight® AIR fixtures with embedded smart sensor
2. Install the wireless battery-powered wall switch
3. With CL*AIR*ITY PROapp, pair the fixtures with the wall switch and if desired, customize the sensor settings for the desired outcome

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MOUNTING INFORMATION

For unit or row installation; surface or suspend mounting.

Suspension Methods:

Aircraft Cable Suspension

Order one BLWPCG_, BLWPCGF_, or BLWPCGE_ required for each suspension point.

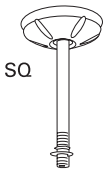
F1 for use with most T-bar and screw slot grid ceiling applications. Designed for on-grid and off-grid installations.

F2 for use with recessed or surface-mount horizontal J-box applications..

See Accessories page on page 3 for part numbers configurations.

Stem Suspension

Individual installation — Two single-stem hangers required.

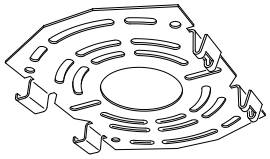


Note: 2' configurations with emergency option cannot be stem mounted.

Accessory Images

(QMB) Quick Mount Bracket

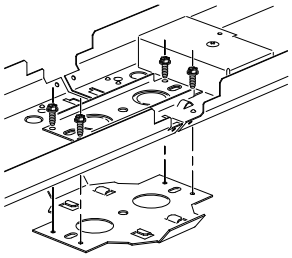
Quick Mount Bracket allows easy installation to junction boxes without having to remove any parts in the fixture.



Note: 2' and 8' configurations not available with QMB accessory.

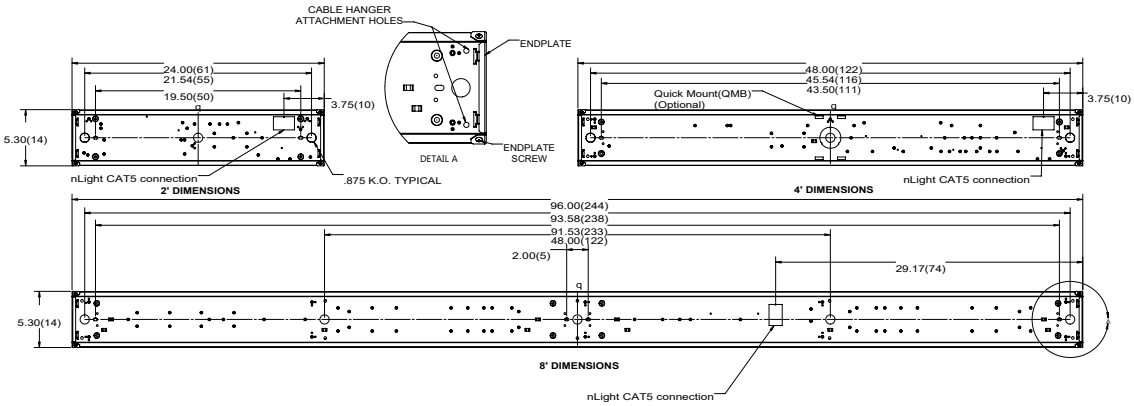
BLWPCR - continuous row mount bracket

Order one (1) BLWPCR bracket per fixture for continuous row applications. Order one hanger(Aircraft Cable Suspension Kit or Stem Suspension Kit) per fixture plus one per joiner required.



DIMENSIONS

All dimensions are inches (centimeters) unless otherwise noted.



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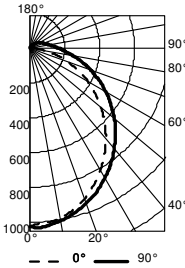
PHOTOMETRICS

BLWP2 33L ADP LP835, 3332 delivered lumens, test no. ISF 37666, tested in accordance to IESNA LM-79.



CP Summary

	0°	90
0°	1024	1024
5°	1009	1027
15°	962	982
25°	867	910
35°	745	809
45°	604	694
55°	456	567
65°	303	436
75°	158	309
85°	36	202
90	0	161

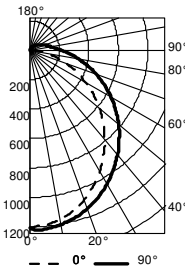
Coefficients of Utilization

pf	80%			20% 70%			50%		
pc									
RCR pw	70%	50%	30%	50%	30%	10%	50%	30%	10%
0	117	117	117	114	114	114	107	107	107
1	106	100	96	97	93	89	92	88	85
2	96	87	79	84	78	72	79	74	69
3	87	76	67	74	66	59	70	63	57
4	79	67	58	65	57	50	62	54	49
5	73	60	51	58	50	43	55	48	42
6	67	54	45	52	44	38	50	42	37
7	62	49	40	48	39	33	45	38	32
8	58	44	36	43	35	30	41	34	29
9	54	41	32	40	32	27	38	31	26
10	51	38	30	37	29	24	35	28	24

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	790	23.7	23.7
0° - 40°	1286	38.6	38.6
0° - 60°	2278	68.4	68.4
0° - 90°	3096	92.9	92.9
90° - 120°	184	5.5	5.5
90° - 130°	210	6.3	6.3
90° - 150°	233	7.0	7.0
90° - 180°	236	7.1	7.1
0° - 180°	3332	100.0	100.0

BLWP2 40L ADP LP835, 3923 delivered lumens, test no. ISF 37668, tested in accordance to IESNA LM-79.



CP Summary

	0°	90
0°	1210	1210
5°	1190	1219
15°	1130	1178
25°	1019	1100
35°	870	990
45°	706	856
55°	527	711
65°	352	560
75°	179	406
85°	37	268
90	1	214

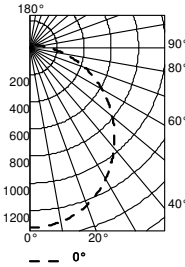
Coefficients of Utilization

pf	80%			20% 70%			50%		
pc									
RCR pw	70%	50%	30%	50%	30%	10%	50%	30%	10%
0	117	117	117	114	114	114	107	107	107
1	106	100	96	97	93	89	92	88	85
2	96	87	80	84	78	72	80	74	69
3	87	76	67	74	66	60	70	63	58
4	80	67	58	65	57	50	62	55	49
5	73	60	51	58	50	43	55	48	42
6	67	54	45	52	44	38	50	42	37
7	62	49	40	48	39	33	45	38	32
8	58	44	36	43	35	30	41	34	29
9	54	41	32	40	32	27	38	31	26
10	51	38	30	37	29	24	35	28	24

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	932	23.8	23.8
0° - 40°	1519	38.7	38.7
0° - 60°	2687	68.5	68.5
0° - 90°	3646	92.9	92.9
90° - 120°	215	5.5	5.5
90° - 130°	246	6.3	6.3
90° - 150°	273	7.0	7.0
90° - 180°	277	7.1	7.1
0° - 180°	3923	100.0	100.0

BLWP4 40L ADP LP835, 4391 delivered lumens, test no. ISF 37596, tested in accordance to IESNA LM-79.



CP Summary

	0°
0°	1324
5°	1321
15°	1274
25°	1180
35°	1043
45°	881
55°	705
65°	521
75°	343
85°	191
90	138

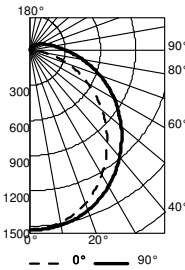
Coefficients of Utilization

pf	80%			20% 70%			50%		
pc									
RCR pw	70%	50%	30%	50%	30%	10%	50%	30%	10%
0	117	117	117	114	114	114	107	107	107
1	106	100	95	97	93	89	92	88	85
2	96	87	79	84	77	72	79	74	69
3	87	76	67	74	66	59	70	63	57
4	79	67	58	65	57	50	62	54	49
5	73	60	50	58	49	43	55	48	42
6	67	54	44	52	44	37	50	42	36
7	62	48	40	47	39	33	45	38	32
8	58	44	36	43	35	29	41	34	29
9	54	41	32	40	32	26	38	31	26
10	51	37	29	37	29	24	35	28	23

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	1028	23.4	23.4
0° - 40°	1681	38.3	38.3
0° - 60°	2991	68.1	68.1
0° - 90°	4082	93.0	93.0
90° - 120°	249	5.7	5.7
90° - 130°	282	6.4	6.4
90° - 150°	307	7.0	7.0
90° - 180°	309	7.0	7.0
0° - 180°	4391	100.0	100.0

BLWP4 48L ADP LP835, 5137 delivered lumens, test no. ISF 37597, tested in accordance to IESNA LM-79.



CP Summary

	0°	90
0°	1528	1528
5°	1517	1528
15°	1447	1488
25°	1311	1398
35°	1129	1267
45°	913	1102
55°	691	920
65°	460	731
75°	233	540
85°	52	370
90	1	300

Coefficients of Utilization

pf	80%			20% 70%			50%		
pc									
RCR pw	70%	50%	30%	50%	30%	10%	50%	30%	10%
0	117	117	117	114	114	114	107	107	107
1	105	100	95	97	93	89	91	88	84
2	95	86	79	84	77	71	79	73	69
3	87	75	67	73	65	59	69	62	57
4	79	67	57	65	56	50	61	54	48
5	73	59	50	58	49	43	55	47	41
6	67	53	44	52	43	37	49	42	36
7	62	48	39	47	39	33	45	37	32
8	58	44	35	43	35	29	41	34	28
9	54	40	32	39	32	26	38	31	26
10	51	37	29	36	29	24	35	28	23

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	1188	23.1	23.1
0° - 40°	1944	37.8	37.8
0° - 60°	3464	67.4	67.4
0° - 90°	4754	92.5	92.5
90° - 120°	308	6.0	6.0
90° - 130°	349	6.8	6.8
90° - 150°	381	7.4	7.4
90° - 180°	383	7.5	7.5
0° - 180°	5137	100.0	100.0

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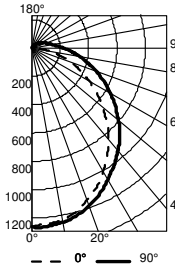
PHOTOMETRICS

BLWP8 40L ADP LP835, 4113 delivered lumens, test no. ISF 37290P226.



CP Summary

	0°	90
0°	1263	1263
5°	1246	1263
15°	1197	1223
25°	1083	1134
35°	928	1011
45°	750	871
55°	558	722
65°	378	564
75°	200	410
85°	57	278
90	9	221

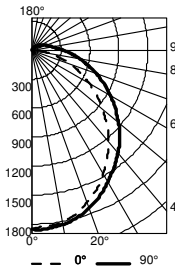
Coefficients of Utilization

pf	80%			70%			50%		
pc	20%								
RCR pw	70%	50%	30%	50%	30%	10%	50%	30%	10%
0	117	117	117	114	114	114	107	107	107
1	106	100	95	97	93	89	92	88	85
2	96	87	79	84	77	72	79	74	69
3	87	76	67	74	66	59	70	63	57
4	79	67	58	65	57	50	62	54	49
5	73	60	51	58	50	43	55	48	42
6	67	54	45	52	44	38	50	42	37
7	62	49	40	48	39	33	45	38	32
8	58	44	36	43	35	30	41	34	29
9	54	41	32	40	32	27	38	31	26
10	51	38	30	37	29	24	35	28	24

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	979	23.8	23.8
0° - 40°	1593	38.7	38.7
0° - 60°	2811	68.4	68.4
0° - 90°	3825	93.0	93.0
90° - 120°	233	5.7	5.7
90° - 130°	263	6.4	6.4
90° - 150°	286	7.0	7.0
90° - 180°	288	7.0	7.0
0° - 180°	4113	100.0	100.0

BLWP8 60L ADP LP835, 6033 delivered lumens, test no. ISF 37290P386.



CP Summary

	0°	90
0°	1853	1853
5°	1827	1853
15°	1756	1794
25°	1588	1664
35°	1361	1483
45°	1101	1277
55°	819	1059
65°	555	828
75°	294	601
85°	84	408
90	13	323

Coefficients of Utilization

pf	80%			70%			50%		
pc	20%								
RCR pw	70%	50%	30%	50%	30%	10%	50%	30%	10%
0	117	117	117	114	114	114	107	107	107
1	106	100	95	97	93	89	92	88	85
2	96	87	79	84	77	72	79	74	69
3	87	76	67	74	66	59	70	63	57
4	79	67	58	65	57	50	62	54	49
5	73	60	51	58	50	43	55	48	42
6	67	54	45	52	44	38	50	42	37
7	62	49	40	48	39	33	45	38	32
8	58	44	36	43	35	30	41	34	29
9	54	41	32	40	32	27	38	31	26
10	51	38	30	37	29	24	35	28	24

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	1437	23.8	23.8
0° - 40°	2336	38.7	38.7
0° - 60°	4124	68.4	68.4
0° - 90°	5611	93.0	93.0
90° - 120°	342	5.7	5.7
90° - 130°	386	6.4	6.4
90° - 150°	420	7.0	7.0
90° - 180°	423	7.0	7.0
0° - 180°	6034	100.0	100.0

PRODUCT INFORMATION

Advanced plug-in system with three-circuit capability. Available on industrial and strip products and a variety of architectural products mounted in continuous rows. 1, 2, 3 and 4-lamp fixtures. PLR22 (2-circuit) and PLR33 (3-circuit) crossover harness switches hot circuit serving next fixture in row. Reduces fixture types on job for alternating circuit applications (see example below.)

Easy one-step installation, saves up to 35% on labor costs. Expanded switching flexibility helps save energy.

Rows can be 50% longer with two-circuit systems. Polarized, lock-together nylon connectors prevent miswiring in the field. #12 THHN conductor, rated 600V, 90°C. White neutral wire included. Grounding accomplished by fixture in-row connectors.

CSA certified systems available with up to 2 circuits. G ground required.

Note: Specifications subject to change without notice.

Wiring

PLR

Advanced 3-Circuit Plug-In

ORDERING INFORMATION Lead times will vary depending on options selected. Consult with your sales representative.

Series	Number of hot wires		Branch circuits				Dimming		Ground	
			Circuits to which ballast is connected		Emergency circuit connected					
PLR	(blank)	Not required for 22 or 33	(blank)	Not required for 22 or 33	(blank)	No emergency circuit	LV	Low-voltage dimming	(blank)	No ground in PLR
PLR22	1	Black	A	Black wire	ELA	Emergency circuit wired to black wire			G	Ground. Maximum 2 circuits
PLR33	2	Black and red	B	Red wire	ELB	Emergency circuit wired to red wire				
	3	Black, red and blue	C	Blue wire	ELC	Emergency circuit wired to blue wire				

Typical Applications

- Multiple-circuit and single-circuit for longer continuous rows
- Multiple-circuit with alternating fixtures on separate circuits, 2-circuit (PLR 22) and 3-circuit (PLR 33)
- Multiple circuit with night-lights located along row as desired

TYPICAL APPLICATIONS										
PLR 3 C	PLR 3 C	PLR 3 C	PLR 3 C	PLR 2 B	PLR 2 B	PLR 2 B	PLR 2 B	PLR 1	PLR 1	PLR 1
(All PLR22)										
Circuit A	Circuit B	Circuit A	Circuit B	Circuit A	Circuit B	Circuit A	Circuit B	Circuit A	Circuit B	Circuit A
(All PLR33)										
Circuit A	Circuit B	Circuit C	Circuit A	Circuit B	Circuit C	Circuit A	Circuit B	Circuit C	Circuit A	Circuit B
PLR 3 A	PLR 3 A	PLR 3 A	PLR 3 C	PLR 3 B	PLR 3 B	PLR 3 B	PLR 3 C	PLR 3 A	PLR 3 A	PLR 3 A

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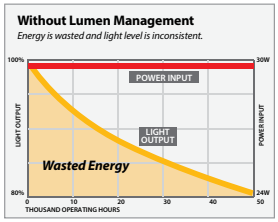
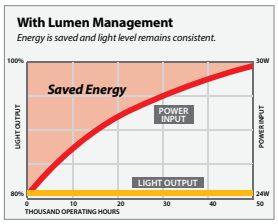
Constant Lumen Management

Enabled by the embedded nLight control, the BLT actively tracks its run-time and manages its light source such that constant lumen output is maintained over the system life. Referred to as lumen management, this feature eliminates the energy waste created by the traditional practice of over-lighting.





How to Estimate Lumens in Emergency Mode
Use the formula below to estimate the delivered lumens in emergency mode
Estimated Lumens = 1.25 x P x LPW
P = Ouput power of emergency driver. P = 10W for E10WLCP option.
LPW = Lumen per watt rating of the luminaire. LPW information available in Performance Data section.

BLWP PERFORMANCE DATA [24]

Lumen Package	Lumens	Input Watts	LPW
BLWP2 8L ADP LP830	825	7	118
BLWP2 8L ADP LP835	855	7	122
BLWP2 8L ADP LP840	868	7	124
BLWP2 8L ADP LP850	893	7	128
BLWP2 20L ADP LP830	1876	17	110
BLWP2 20L ADP LP835	1942	17	114
BLWP2 20L ADP LP840	1973	17	116
BLWP2 20L ADP LP850	2029	17	119
BLWP2 33L ADP LP830	3180	30	107
BLWP2 33L ADP LP835	3332	30	112
BLWP2 33L ADP LP840	3345	30	112
BLWP2 33L ADP LP850	3440	30	115
BLWP2 40L ADP LP830	3914	37	105
BLWP2 40L ADP LP835	3923	37	105
BLWP2 40L ADP LP840	4117	37	110
BLWP2 40L ADP LP850	4234	37	113
BLWP2 48L ADP LP830	4772	44	109
BLWP2 48L ADP LP835	4940	44	112
BLWP2 48L ADP LP840	5019	44	114
BLWP2 48L ADP LP850	5162	44	118
BLWP4 15L ADP LP830	1372	11	126
BLWP4 15L ADP LP835	1420	11	129
BLWP4 15L ADP LP840	1443	11	131
BLWP4 15L ADP LP850	1484	11	135
BLWP4 20L ADP LP830	1985	16	124
BLWP4 20L ADP LP835	2055	16	128
BLWP4 20L ADP LP840	2088	16	131
BLWP4 20L ADP LP850	2147	16	134
BLWP4 30L ADP LP830	2960	25	118
BLWP4 30L ADP LP835	3065	25	123
BLWP4 30L ADP LP840	3114	25	125
BLWP4 30L ADP LP850	3203	25	128
BLWP4 40L ADP LP830	4027	35	115
BLWP4 40L ADP LP835	4391	35	125
BLWP4 40L ADP LP840	4236	35	121
BLWP4 40L ADP LP850	4357	35	124
BLWP4 48L ADP LP830	4948	40	124
BLWP4 48L ADP LP835	5137	40	129
BLWP4 48L ADP LP840	5205	40	131
BLWP4 48L ADP LP850	5353	40	134
BLWP4 60L ADP LP830	6059	49	123
BLWP4 60L ADP LP835	6273	49	127
BLWP4 60L ADP LP840	6373	49	129
BLWP4 60L ADP LP850	6555	49	133
BLWP4 72L ADP LP830	7088	59	121
BLWP4 72L ADP LP835	7338	59	125
BLWP4 72L ADP LP840	7455	59	127
BLWP4 72L ADP LP850	7668	59	131
BLWP4 85L ADP LP830	7972	68	117
BLWP4 85L ADP LP835	8253	68	121
BLWP4 85L ADP LP840	8385	68	123
BLWP4 85L ADP LP850	8624	68	127
BLWP4 100L ADP LP830	9316	85	110
BLWP4 100L ADP LP835	9645	85	114
BLWP4 100L ADP LP840	9799	85	116
BLWP4 100L ADP LP850	10079	85	119

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BLWP PERFORMANCE DATA (continued)

Lumen Package	Lumens	Input Watts	LPW
BLWP2 8LHE ADP LP830	851	8	106
BLWP2 8LHE ADP LP835	881	8	110
BLWP2 8LHE ADP LP840	895	8	112
BLWP2 8LHE ADP LP850	921	8	115
BLWP2 20LHE ADP LP830	1932	16	120
BLWP2 20LHE ADP LP835	2000	16	125
BLWP2 20LHE ADP LP840	2032	16	127
BLWP2 20LHE ADP LP850	2090	16	130
BLWP2 33LHE ADP LP830	3272	26	127
BLWP2 33LHE ADP LP835	3388	26	131
BLWP2 33LHE ADP LP840	3442	26	133
BLWP2 33LHE ADP LP850	3540	26	137
BLWP2 40LHE ADP LP830	3991	32	126
BLWP2 40LHE ADP LP835	4132	32	130
BLWP2 40LHE ADP LP840	4198	32	131
BLWP2 40LHE ADP LP850	4318	32	136
BLWP2 48LHE ADP LP830	4881	39	126
BLWP2 48LHE ADP LP835	5053	39	130
BLWP2 48LHE ADP LP840	5134	39	132
BLWP2 48LHE ADP LP850	5280	39	136
BLWP4 15LHE ADP LP830	1375	11	125
BLWP4 15LHE ADP LP835	1424	11	129
BLWP4 15LHE ADP LP840	1447	11	132
BLWP4 15LHE ADP LP850	1488	11	135
BLWP4 20LHE ADP LP830	1985	16	124
BLWP4 20LHE ADP LP835	2055	16	128
BLWP4 20LHE ADP LP840	2088	16	131
BLWP4 20LHE ADP LP850	2147	16	134
BLWP4 30LHE ADP LP830	3012	24	126
BLWP4 30LHE ADP LP835	3118	24	131
BLWP4 30LHE ADP LP840	3168	24	133
BLWP4 30LHE ADP LP850	3258	24	137
BLWP4 40LHE ADP LP830	4181	33	127
BLWP4 40LHE ADP LP835	4329	33	132
BLWP4 40LHE ADP LP840	4398	33	134
BLWP4 40LHE ADP LP850	4524	33	137
BLWP4 48LHE ADP LP830	5033	39	130
BLWP4 48LHE ADP LP835	5211	39	135
BLWP4 48LHE ADP LP840	5294	39	137
BLWP4 48LHE ADP LP850	5445	39	141
BLWP4 60LHE ADP LP830	6280	47	133
BLWP4 60LHE ADP LP835	6502	47	137
BLWP4 60LHE ADP LP840	6606	47	140
BLWP4 60LHE ADP LP850	6795	47	144
BLWP4 72LHE ADP LP830	7303	56	129
BLWP4 72LHE ADP LP835	7561	56	134
BLWP4 72LHE ADP LP840	7682	56	136
BLWP4 72LHE ADP LP850	7901	56	140
BLWP4 85LHE ADP LP830	8567	69	124
BLWP4 85LHE ADP LP835	8869	69	129
BLWP4 85LHE ADP LP840	9011	69	131
BLWP4 85LHE ADP LP850	9268	69	134
BLWP4 100LHE ADP LP830	9898	80	124
BLWP4 100LHE ADP LP835	10247	80	128
BLWP4 100LHE ADP LP840	10411	80	130
BLWP4 100LHE ADP LP850	10708	80	134

Notes
24 For ADP lens only, for additional lens options refer to photometry on www.acuitybrands.com.

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BLWP8 PERFORMANCE DATA

Lumen Package	Lumens	Input Watts	LPW
BLWP8 40L ADP LP830	3953	30	131
BLWP8 40L ADP LP835	4113	30	136
BLWP8 40L ADP LP840	4107	30	136
BLWP8 40L ADP LP850	4246	30	141
BLWP8 60L ADP LP830	5799	47	122
BLWP8 60L ADP LP835	6034	47	127
BLWP8 60L ADP LP840	6107	47	130
BLWP8 60L ADP LP850	6229	47	132
BLWP8 80L ADP LP830	7643	63	121
BLWP8 80L ADP LP835	7952	63	126
BLWP8 80L ADP LP840	8035	63	127
BLWP8 80L ADP LP850	8210	63	130
BLWP8 100L ADP LP830	9628	82	118
BLWP8 100L ADP LP835	10017	82	123
BLWP8 100L ADP LP840	10133	82	124
BLWP8 100L ADP LP850	10342	82	127
BLWP8 140L ADP LP830	13265	120	111
BLWP8 140L ADP LP835	13802	120	115
BLWP8 140L ADP LP840	13961	120	116
BLWP8 140L ADP LP850	14249	120	119
BLWP8 180L ADP LP830	17781	147	121
BLWP8 180L ADP LP835	18501	147	126
BLWP8 180L ADP LP840	18714	147	127
BLWP8 180L ADP LP850	19101	147	130
BLWP8 200L ADP LP830	18563	156	119
BLWP8 200L ADP LP835	19314	156	124
BLWP8 200L ADP LP840	19537	156	125
BLWP8 200L ADP LP850	19941	156	128

BLWP8 HE PERFORMANCE DATA

Lumen Package	Lumens	Input Watts	LPW
BLWP8 40LHE ADP LP830	3953	30	133
BLWP8 40LHE ADP LP835	4113	30	139
BLWP8 40LHE ADP LP840	4160	30	140
BLWP8 40LHE ADP LP850	4246	30	143
BLWP8 60LHE ADP LP830	5942	46	128
BLWP8 60LHE ADP LP835	6183	46	133
BLWP8 60LHE ADP LP840	6254	46	135
BLWP8 60LHE ADP LP850	6383	46	137
BLWP8 80LHE ADP LP830	7820	59	132
BLWP8 80LHE ADP LP835	8136	59	137
BLWP8 80LHE ADP LP840	8230	59	139
BLWP8 80LHE ADP LP850	8400	59	142
BLWP8 100LHE ADP LP830	9723	74	132
BLWP8 100LHE ADP LP835	10117	74	138
BLWP8 100LHE ADP LP840	10233	74	139
BLWP8 100LHE ADP LP850	10445	74	142
BLWP8 140LHE ADP LP830	13491	104	129
BLWP8 140LHE ADP LP835	14037	104	135
BLWP8 140LHE ADP LP840	14198	104	136
BLWP8 140LHE ADP LP850	14492	104	139
BLWP8 180LHE ADP LP830	17245	130	133
BLWP8 180LHE ADP LP835	17943	130	138
BLWP8 180LHE ADP LP840	18150	130	140
BLWP8 180LHE ADP LP850	18525	130	143
BLWP8 200LHE ADP LP830	19587	144	136
BLWP8 200LHE ADP LP835	20380	144	141
BLWP8 200LHE ADP LP840	20615	144	143
BLWP8 200LHE ADP LP850	21041	144	146

Notes

24 For ADP lens only, for additional lens options refer to photometry on www.acuitybrands.com.

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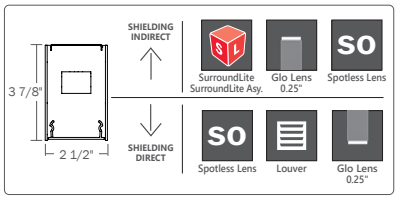
Beam 2 | Pendant mount - Direct / Indirect

Flush Spotless Lens - down
Glo Lens - up

Louver

Glo Lens up and down



Project _____

Type _____

Notes _____

PERFORMANCE PER LINEAR FOOT AT 3500K

NOMINAL LUMEN OUTPUT		INPUT WATTS*	EFFICACY	SHIELDING I/D
UPLIGHT	DOWNLIGHT			
1100 lm/ft	1000 lm/ft	20.6 W/ft	100 lm/W	SL/L
600 lm/ft	500 lm/ft	9.9 W/ft	112 lm/W	0.25G/SO
600 lm/ft	500 lm/ft	9.9 W/ft	114 lm/ft	LED/SO
1100 lm/ft	-	11.2 W/ft	106 lm/ft	SLA
1100 lm/ft	-	10.7 W/ft	103 lm/W	SL
-	1000 lm/ft	9.9 W/ft	97 lm/W	L

Please consult factory for custom lumen output and wattage.

*Check the latest update on the DLC website for complete information. Not all versions may be DLC qualified.
See page 2 for DLC Approved Options

SurroundLite™ · Axitune Dim-to-Warm · Axitune Tunable White · PoE · Control · bios ILLUMINATED · c UL us Listed

Ordering Guide

TB2DILED

PRODUCT ID		NOM. LUM/FT UP		NOM. LUM/FT DOWN		CRI		COLOR TEMP.				SHIELDING INDIRECT	
TB2DILED	Beam2 - Pendant Direct/Indirect LED	**400**	400 lm/ft - Min.	**400**	400 lm/ft - **min**	**80**	80 CRI	**27**	2700 K	**B30**	3000 K - Bios*	**SO**	spotless lens
		1100	1100 lm/ft - Max.	**750**	750 lm/ft - **max**	**90**	90 CRI*	**30**	3000 K	**B35**	3500 K - Bios*	**SL**	surroundlite
				1000	1000 lm/ft - max for louver*			**35**	3500 K	**B40**	4000 K - Bios*	**SLA**	surroundlite asym.
								40	4000 K	**TW2750**	2700-5000 K - Tunable White	**0.25G**	0.25" Glo lens
										TW2765	2700-6500 K - Tunable White		
										DW3020	3000-2000 K - Dim to Warm		
		Outputs between listed min and max are available. Consult factory for outputs outside of the listed range. Consult factory for max output with BIOS		Outputs between listed min and max are available. Consult factory for outputs outside of the listed range. Consult factory for max output with BIOS * 1000lm/ft with louver		* Not available with Bios.		Consult Axitune technical sheet for more information of color technology. *Consult BIOS guide for more information on BIOS technology				Choose only one of the options above	

SHIELDING DIRECT		LENGTH (FT)		MR (OPTIONAL)		FINISH		VOLTAGE		DRIVER		CIRCUITS	
SO	spotless lens	**2**	2'	**DMLED(#)**	downlight module LED	**AP**	aluminum paint	**120**	120 V	**DP**	dimming (0-10V) 1%	**1**	1 circuit
L	louver*	**3**	3'			**W**	white	**277**	277 V	**LT(#)**	Lutron*	**2**	2 circuits
0.25G	0.25" Glo lens	**4**	4'			**BLK**	black	**347**	347 V	**BI**	bi-level dimming	**+E(#)**	emergency circuit*
UB	ultra blend lens**	**5**	5'			**C**	custom	**UNV**	universal	**O(#)**	other**	**+NL(#)**	night light circuit*
		8	8'					**DC**	low voltage*	**DPB(#)**	dimming (0-10V) 1% with Bios*	**+GTD(#)**	generator transfer device*
		12	12'							**TW(#)**	tunable white drivers*		
		S(L)	System Run *							**POE(#)**	POE drivers*	**+M**	MR
Choose only one of the options above; SurroundLite not available with direct. *Available in 3' and 4' combinations; otherwise consult factory. **Default lens for Tunable white and BIOS. Consult factory for other lens.		* SurroundLite available in 1' increments		Add 6" per lamp, Specify quantity Separate circuits included. Requires 120V or 277. Available in luminaires with Axitune and BIOS but downlight modules will not be tunable white or BIOS LEDs				* Only available with POE drivers.		*See page 2 to specify system **Please consult factory; see page 2		*Specify quantity	

MOUNTING/SUSPENSION		BATTERY (OPTIONAL)		OTHER (OPTIONAL)		IC CONTROLS (OPTIONAL)		CUSTOM (OPTIONAL)	
CA(L)	drywall+cable length (36" std.)	**B(#)**	battery pack (integral)	**F**	fuse*	**DS(#)**	daylight sensor	**C**	custom
CT9(L)	TB/TG 9/16+cable length (36" std.)					**OS(#)**	occupancy sensor		
CT15(L)	TB/TG15/16+cable length (36" std.)					**DOS(#)**	daylight & occupancy sensor		
CTS(L)	ST+cable length (36" std.)					**EN(#)**	Enlighted integral*		
SA(L)	drywall+stem length >48" (18" std.)					**ENR(#)**	Enlighted remote*		
						WC(#)	wireless control dimming		
White canopy standard		Minimum 5ft; Not available with 347V Please consult factory.		*Requires 120V or 277V		*Please consult factory Specify quantity. Requires 8" blank. See integrated controls guide for more details. Consult factory for Tunable White. Not available with DPB (DY) driver for BIOS with Dynamic Spectrum.		Please specify	

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SPECIFICATIONS

CONSTRUCTION

Housing	Extruded aluminum (0.075'' nominal) Up to 70% recycled content
End Cap	Cast aluminum
Interior Brackets	Die formed sheet steel (20 gauge)
Reflectors	White powder coated sheet steel (22 gauge)
Louvers	Die formed semi-specular aluminum (22 gauge)
Lenses	Extruded acrylic (0.070'' nominal)
Hanger	adjustable slide mount
Suspension	Y shape aircraft cable or Ø 1/2" stem

ELECTRICAL

Lutron driver*	**LDE1** - Hi-lume 1% EcoSystem with Soft-on, Fade-to-Black **LDE5** - 5-Series EcoSystem **LTEA** - Hi-lume 1% 2-wire (120V forward phase only) *Consult factory
Other drivers**	**DALI** - Digital Addressable Lighting Interface **DMX** - Digital Multiplex **LV** - line voltage - Advance Mark 10 **Xitanium SR** - For wireless sensor
BIOS DPB drivers*	**STC** - BIOS control 0-10V with static spectrum and BIOS SkyBlue enabled from 100% to 1%. **DYN**- BIOS control 0-10V with dynamic spectrum and BIOS SkyBlue® with Bio-Dimming™ enabled 100% to 50%, light output dimming from 49% to 1%.
Tunable White TW drivers*	**DALIDT6** - DALI Type 6 (Two DALI Addresses) **DALIDT8** - DALI Type 8 (One DALI Address) **LTTW** - Lutron T-Series Tunable White
Power over Ethernet POE drivers* UL2108 certified for integral or remote driver	MOLEX IGOR **O** - Other (Consult factory)
Emergency	Integral emergency battery pack or emergency circuit optional.
Input Voltage	120V, 277V, 347V, UNV, DC.

*Choose driver from available options.

Incorporating these components may have limitations or affect the length of the luminaire. Please contact factory for more details.

DLC Approved Options

*Check the latest update on the DLC website for complete information. Not all versions may be DLC qualified.

OUTPUT UP	OUTPUT DOWN	CRI	COLOR TEMP.	SHIELDING INDIRECT	SHIELDING DIRECT	LENGTH	FINISH	VOLTAGE	DRIVER	CIRCUITS
400 lm/ft	600 lm/ft	80	3500 K	SL	SO	4' 6' 7' 8' 10'	white	universal	DP	1

LED SYSTEM

CRI	Minimum 80 or 90 color rendering index.
CRI BIOS	Minimum 80 color rendering index with R9>90 for all CCTs.
CCT Single Color	Choice of 2700K, 3000K, 3500K and 4000K color temperature with a great color consistency (within 3–step MacAdam ellipse). Both within fixture and fixture to fixture.
CCT BIOS	BIOS Static (STC) Choice of 3000K, 3500K and 4000K. BIOS SkyBlue® Dynamic (DYN) Choice of 3000K, 3500K, and 4000K with Bio-Dimming™ Consult BIOS guide for more information on BIOS technology.
CCT Axitune Systems	Consult Axitune technical sheet for more information on color technology.
LED life	Minimum 50,000h with 85% of lumen maintenance in 25°C ambient temperature, in compliance with IES LM-80 testing measurements.
Thermal Management	Aluminum housing acting as the heat sink to maximize life.
Environment	Dry and damp rated in operating ambient temperatures of 0-40°C (32-104F).

OPTICS

SO Spotless lens
UB Ultra Blend lens

L Louver

0.25G Glo lens

ULTRA BLEND LENS
Frosted acrylic snap-in micro lens suitable for Tunable White and BIOS applications.

SPOTLESS LENS
Frosted acrylic snap-in micro lens

PARABOLIC LOUVERS
Die formed semi-specular aluminum (22 gauge)

GLO LENS
0.25" frosted acrylic drop lens. Patented design.

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WARRANTY

Axis Lighting will warrant defective LEDs, boards, and drivers for 5 years from date of purchase. Warranty is valid if luminaire is installed and used according to specifications. If defective, Axis will send replacement boards or drivers at no cost along with detailed replacement instructions and instructions on how to return defective components to Axis.

WEIGHT

Direct/Indirect 4 ft	13.2 lbs / 6.0 kg
Direct/Indirect 8 ft	26.4 lbs / 12.0 kg
Direct/Indirect 12 ft	39.6 lbs / 18.0 kg

SYSTEM (S#)

BEAM2 SurroundLite linear systems, with the use of a strong profile, allow for a nearly hair thin connection system of continuous runs. Lengths of 4', 8', 12' as well as custom lengths are available. Runs of BEAM2 SurroundLite that are greater than 12' in length are designated as systems (S#). This means that the run is comprised of a combination of 4', 8' and/or 12' sections to be assembled on site using our joining system. System runs with SurroundLite available in 1' increments only. For more information on systems and joining, please refer to the BEAM installation sheets available for download at www.axislighting.com.

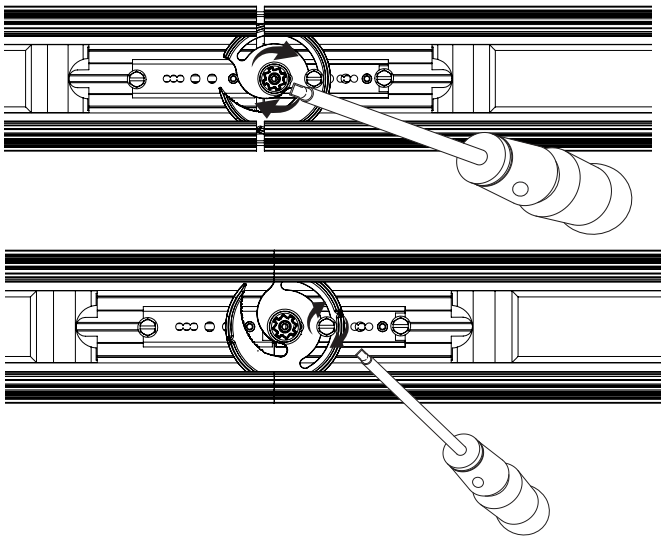
InstaJoiner

BEAM2 SurroundLite luminaires feature InstaJoiner, a unique, patent-pending joining system developed by Axis offering fast, single-screw tightening.

NOTE: Mount each system segment individually.

Do not assemble system prior to mounting

Allow a minimum of 6" between end of long runs and wall.



Patent - Pending

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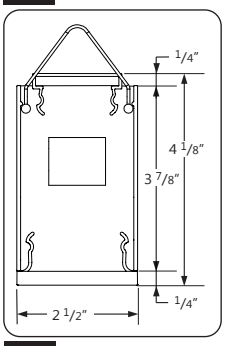
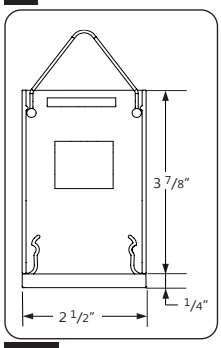
SECTION VIEWS

0.25G 0.25" Glo lens - Indirect



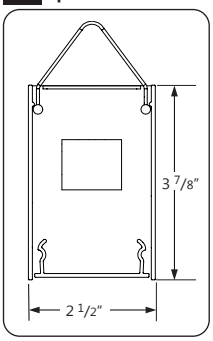
0.25G 0.25" Glo lens - Direct

SL SurroundLite - Indirect



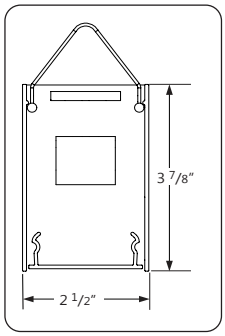
0.25G 0.25" Glo lens - Direct

SO Spotless lens - Indirect



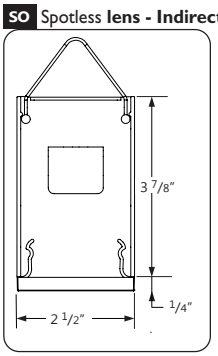
SO Spotless lens - Direct

SL SurroundLite - Indirect



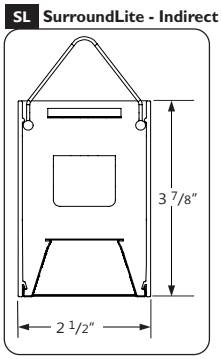
SO Spotless lens - Direct

SO Spotless lens - Indirect



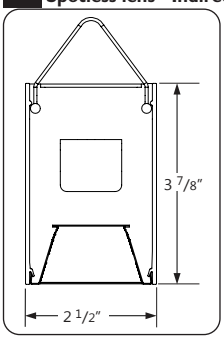
0.25G 0.25" Glo lens - Direct

SL SurroundLite - Indirect



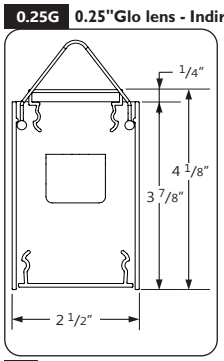
L Louver - Direct

SO Spotless lens - Indirect



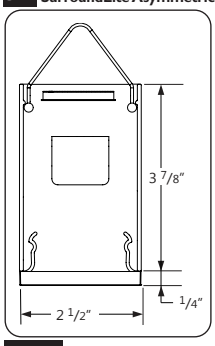
L Louver - Direct

0.25G 0.25"Glo lens - Indirect



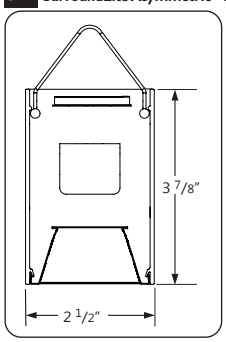
SO Spotless lens - Direct

SLA SurroundLite Asymmetric - Indirect



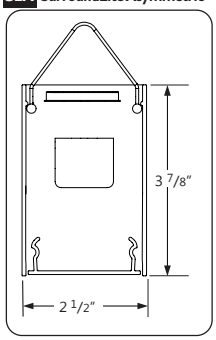
0.25G 0.25" Glo lens - Direct

SLA SurroundLite Asymmetric - Indirect



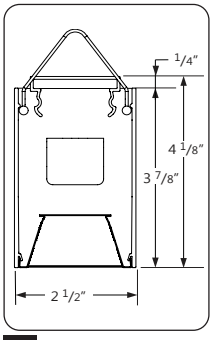
L Louver - Direct

SLA SurroundLite Asymmetric - Indirect



SO Spotless lens - Direct

0.25G 0.25" Glo lens - Indirect



L Louver - Direct

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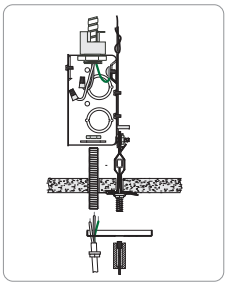
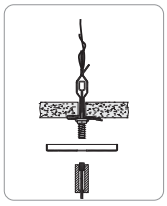
MOUNTING OPTIONS

CT TILE CEILING - ON GRID

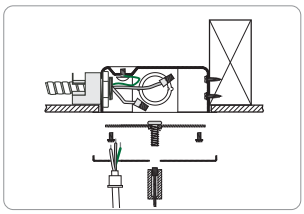


Power feed

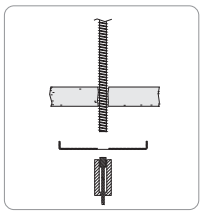


Non power feed

CA DRYWALL CEILING

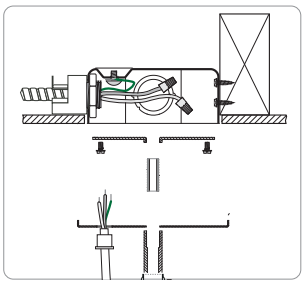


Power feed

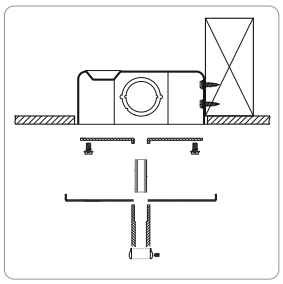


Non power feed

SA STEM MOUNT IN DRYWALL CEILING



Power feed



Non power feed

OTHER MOUNTING OPTIONS

BEAM2 SurroundLite is also available with wall and horizontal wall mounted options.

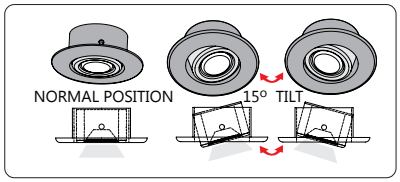
Specification sheets and installation sheets for all mountings for BEAM2 SurroundLite luminaires are available for download at www.axislighting.com

FINISH

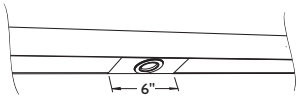
Aluminium paint, powder coated and custom finishes are also available.

DMLED MODULE

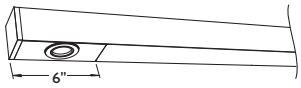
Blank	Extruded aluminum (0.075'' nominal)
LED Module	2'' diameter
Quantity	For every 4' section, there may be up to a maximum of 4 x DMLED module.
Spacing	Each DMLED module is placed centered on a blank section 6'' in length. For a series of modules within a given section length, they will be spaced evenly on a longer blank section. Custom spacing may be available on special request.
Tilt	15° each side.



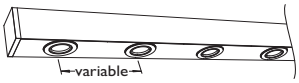
Between sections



At luminaire ends



Several in a long blank section



Beam Angle	30 nominal degrees
Input Watts	3W
Nominal Lumens	126 lumens
Efficacy	42 lumens per watt
Color Rendering Index (CRI)	80
Life	25,000 hours at L_{70}
Correlated color temperature (CCT)	3000K

More options are available upon request. Please consult factory.

* See photometric report.

APPROVALS

Certified to UL and CUL standards
Meets NYC requirements
Meets ADA requirements.
Suitable for damp locations.

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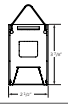
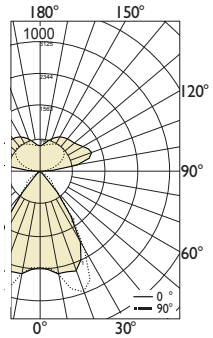
● *PHOTOMETRIC DATA*

SL SurroundLite - **Up**
L louver - **Down**

Uplight
1100 lm/ft
Downlight
1000 lm/ft



PHOTOMETRIC CURVE



Lumen/ft up: 1100 lm/ft
Lumen/ft down: 1000 lm/ft
Total Lumens: 8257 lm (for 4ft)
Input Watts: 82.3 W
Efficacy: 100 lm/W
IES FILE: TB2DILED-1100-1000-80-35-SL-L-4.IES

TESTED ACCORDING TO IES LM-79-2008

CANDELA DISTRIBUTION

	Horizontal Angles				
Vertical Angle	0	22.5	45	67.5	90
0	2297	2297	2297	2297	2297
5	2356	2348	2337	2321	2312
15	2483	2504	2693	2915	2904
25	2322	2513	3107	3055	2851
35	1290	1752	2342	1633	1320
45	194	307	658	478	428
55	32	48	76	175	250
65	6	8	13	17	20
75	2	2	3	5	5
85	0	1	1	1	1
90	3	3	2	2	2
95	293	308	219	124	66
105	1221	1009	538	368	315
115	1276	1039	697	585	553
125	1119	997	815	737	706
135	1040	986	885	811	779
145	991	960	889	816	779
155	900	879	823	756	725
165	758	745	711	675	660
175	633	631	627	622	620
180	614	614	614	614	614

ZONAL LUMENS

Zone	Lumens
0	
0-10	228
10-20	768
20-30	1260
30-40	1073
40-50	397
50-60	106
60-70	19
70-80	4
80-90	1
90	
90-100	250
100-110	688
110-120	799
120-130	775
130-140	693
140-150	555
150-160	378
160-170	203
170-180	61
180	

LUMINANCE DATA (cd/m²)

	Horizontal Angles		
Vertical Angle	0	45	90
45	4597	15642	10171
55	949	2223	7334
65	219	521	807
75	110	208	312
85	77	154	212

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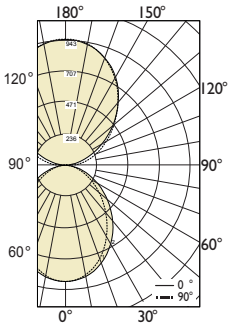
● *PHOTOMETRIC DATA*

0.25G 0.25" Glo lens - **Up**
SO spotless lens - **Down**

Uplight
600 lm/ft
Downlight
500 lm/ft

PHOTOMETRIC CURVE



Lumen/ft up: 600 lm/ft
Lumen/ft down: 500 lm/ft
Total Lumens: 4418 lm (for 4ft)
Input Watts: 39.6 W
Efficacy: 112 lm/W
IES FILE: TB2DILED-600-500-80-35-0.25G-SO-4.IES

TESTED ACCORDING TO IES LM-79-2008

CANDELA DISTRIBUTION

Vertical Angle	Horizontal Angles 0	22.5	45	67.5	90
0	871	871	871	871	871
5	863	863	864	865	865
15	799	802	809	818	820
25	686	693	710	728	736
35	546	556	583	609	619
45	406	417	445	474	485
55	280	290	314	340	349
65	173	181	198	217	223
75	88	91	101	111	115
85	21	22	25	29	31
90	1	1	1	1	2
95	103	98	80	55	32
105	195	189	170	145	124
115	297	292	280	262	247
125	414	412	408	401	392
135	545	545	550	548	543
145	682	684	691	692	690
155	805	806	812	812	813
165	895	894	897	894	895
175	938	938	940	936	936
180	942	942	942	942	942

ZONAL LUMENS

Zone	Lumens
0	
0-10	82
10-20	228
20-30	327
30-40	364
40-50	344
50-60	282
60-70	198
70-80	108
80-90	31
90	
90-100	73
100-110	176
110-120	275
120-130	364
130-140	422
140-150	430
150-160	373
160-170	252
170-180	89
180	

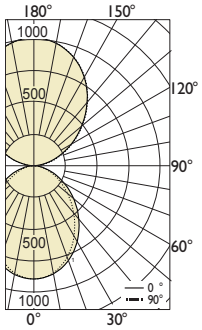
LUMINANCE DATA (cd/m²)

Vertical Angle	Horizontal Angles 0	45	90
45	9554	10484	11427
55	8130	9123	10148
65	6835	7817	8802
75	5645	6495	7389
85	4014	4817	5964

SO spotless lens - **Up**
SO spotless lens - **Down**

Uplight
600 lm/ft
Downlight
500 lm/ft

PHOTOMETRIC CURVE



Lumen/ft up: 600 lm/ft
Lumen/ft down: 500 lm/ft
Total Lumens: 4487 lm (for 4ft)
Input Watts: 39.5 W
Efficacy: 114 lm/W
IES FILE: TB2DILED-600-500-80-35-SO-SO-4.IES

TESTED ACCORDING TO IES LM-79-2008

CANDELA DISTRIBUTION

Vertical Angle	Horizontal Angles 0	22.5	45	67.5	90
0	883	883	883	883	883
5	875	875	876	877	877
15	810	813	820	827	829
25	696	703	718	734	740
35	554	564	588	610	619
45	412	423	448	474	483
55	284	294	316	340	348
65	176	183	200	217	222
75	89	93	102	112	114
85	21	23	26	29	31
90	1	1	1	1	1
95	48	47	46	43	38
105	154	154	151	145	142
115	277	276	278	276	273
125	420	421	421	423	421
135	574	575	576	577	575
145	724	725	727	727	727
155	853	853	854	854	854
165	944	944	944	945	944
175	990	989	989	989	990
180	994	994	994	994	994

ZONAL LUMENS

Zone	Lumens
0	
0-10	83
10-20	231
20-30	330
30-40	367
40-50	346
50-60	284
60-70	199
70-80	109
80-90	31
90	
90-100	50
100-110	159
110-120	274
120-130	377
130-140	444
140-150	454
150-160	393
160-170	266
170-180	94
180	

LUMINANCE DATA (cd/m²)

Vertical Angle	Horizontal Angles 0	45	90
45	7949	8655	9324
55	6771	7533	8275
65	5700	6459	7186
75	4701	5387	6025
85	3353	4011	4888

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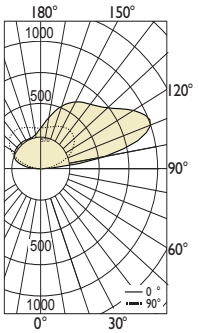
● *PHOTOMETRIC DATA*

SLA SurroundLite asymmetric - **Up**

Uplight
1100 lm/ft
Downlight
0 lm/ft

PHOTOMETRIC CURVE



Lumen/ft up: 1100 lm/ft
Lumen/ft down: 0 lm/ft
Total Lumens: 4634 lm (for 4ft)
Input Watts: 44.7 W
Efficacy: 104 lm/W
IES FILE: TB2DILED-1100-0-80-35-SLA-4.IES

TESTED ACCORDING TO IES LM-79-2008

CANDELA DISTRIBUTION

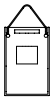
Vertical Angle	Horizontal Angles 0	22.5	45	67.5	90	112.5	135	157.5	180
90	0	0	0	0	0	0	0	0	0
95	228	325	263	142	83	132	163	188	186
105	1938	1724	828	456	357	353	368	432	463
115	2239	1803	1021	729	615	544	490	531	569
125	1860	1589	1165	942	784	660	569	574	595
135	1572	1477	1258	1054	870	709	608	594	600
145	1440	1403	1258	1073	879	715	619	595	594
155	1289	1259	1156	993	833	699	619	589	582
165	1060	1036	970	873	774	688	630	600	590
175	818	811	793	766	735	705	681	664	659
180	727	727	727	727	727	727	727	727	727

ZONAL LUMENS

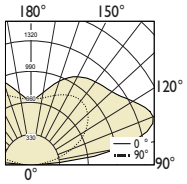
Zone	Lumens
90	
90-100	216
100-110	714
110-120	860
120-130	826
130-140	729
140-150	585
150-160	407
160-170	227
170-180	71
180	

SL SurroundLite - **Up**

Uplight
1100 lm/ft
Downlight
0 lm/ft



PHOTOMETRIC CURVE



Lumen/ft up: 1100 lm/ft
Lumen/ft down: 0 lm/ft
Total Lumens: 4396 lm (for 4ft)
Input Watts: 42.7 W
Efficacy: 103 lm/W
IES FILE: TB2DILED-1100-0-80-35-SL-4.IES

TESTED ACCORDING TO IES LM-79-2008

CANDELA DISTRIBUTION

Vertical Angle	Horizontal Angles 0	22.5	45	67.5	90
90	3	3	2	2	2
95	293	308	219	124	66
105	1221	1009	538	368	315
115	1276	1039	697	585	553
125	1119	997	815	737	706
135	1040	986	885	811	779
145	991	960	889	816	779
155	900	879	823	756	725
165	758	745	711	675	660
175	633	631	627	622	620
180	614	614	614	614	614

ZONAL LUMENS

Zone	Lumens
90	
90-100	236
100-110	693
110-120	800
120-130	775
130-140	693
140-150	556
150-160	379
160-170	203
170-180	61
180	

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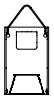
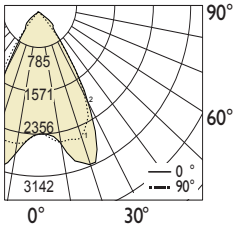
● *PHOTOMETRIC DATA*

L louver - **Down**

Uplight
0 lm/ft
Downlight
1000 lm/ft



PHOTOMETRIC CURVE



Lumen/ft up: 0 lm/ft
Lumen/ft down: 1000 lm/ft
Total Lumens: 3645 lm (for 4ft)
Input Watts: 39.6 W
Efficacy: 97 lm/W
IES FILE: TB2DILED-0-1000-80-35-L-4.IES

TESTED ACCORDING TO IES LM-79-2008

CANDELA DISTRIBUTION

	Horizontal Angles				
Vertical Angle	0	22.5	45	67.5	90
0	2297	2297	2297	2297	2297
5	2356	2348	2337	2321	2312
15	2483	2504	2693	2915	2904
25	2322	2513	3107	3055	2851
35	1290	1752	2342	1633	1320
45	194	307	658	478	428
55	32	48	76	175	250
65	6	8	13	17	20
75	2	2	3	5	5
85	0	1	1	1	1
90	0	0	0	0	0

ZONAL LUMENS

	Lumens
Zone	
0	
0-10	233
10-20	787
20-30	1216
30-40	951
40-50	329
50-60	93
60-70	19
70-80	10
80-90	8
90	

LUMINANCE DATA (cd/m²)

	Horizontal Angles		
Vertical Angle	0	45	90
45	4597	15642	10171
55	949	2223	7334
65	219	521	807
75	110	208	312
85	77	154	212

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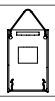
Beam 2 | Pendant mount - Direct / Indirect

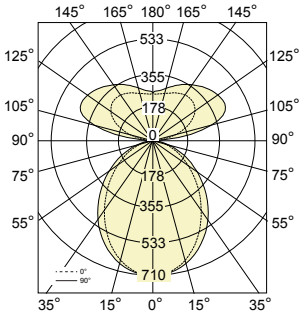
● PHOTOMETRIC DATA

SL SurroundLite - **Up**
SO spotless lens - **Down**

Uplight
400 lm/ft
Downlight
400 lm/ft



PHOTOMETRIC CURVE



Lumen/ft up: 400 lm/ft
Lumen/ft down: 400 lm/ft
Total Lumens: 3200 lm (for 4ft)
Input Watts: 28.8 W
Efficacy: 111 lm/W
IES FILE: TB2DILED-400-400-80-35-SL-SO-4.IES

TESTED ACCORDING TO IES LM-79-2008

CANDELA DISTRIBUTION

Vertical Angle	Horizontal Angles 0	22.5	45	67.5	90
0	710	710	710	710	710
5	704	704	705	706	706
15	652	654	660	667	669
25	560	565	580	594	600
35	445	454	475	497	505
45	331	340	363	387	396
55	228	236	256	278	285
65	141	147	162	177	182
75	72	75	82	91	94
85	17	18	21	24	25
90	2	1	2	2	2
95	25	45	56	64	56
105	121	148	205	287	319
115	212	235	286	371	422
125	270	291	328	386	420
135	295	312	339	375	394
145	295	306	330	352	361
155	278	286	306	320	325
165	259	265	279	285	288
175	248	252	263	264	264
180	254	254	254	254	254

ZONAL LUMENS

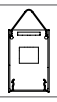
Zone	Lumens
0	
0-10	67
10-20	186
20-30	267
30-40	297
40-50	280
50-60	230
60-70	161
70-80	88
80-90	24
90	
90-100	63
100-110	223
110-120	297
120-130	301
130-140	265
140-150	207
150-160	141
160-170	79
170-180	25
180	

LUMINANCE DATA (cd/m²)

Vertical Angle	Horizontal Angles 0	45	90
45	7795	8554	9323
55	6633	7444	8280
65	5577	6378	7182
75	4606	5299	6029
85	3275	3930	4866

SL SurroundLite - **Up**
SO spotless lens - **Down**

Uplight
1100 lm/ft
Downlight
400 lm/ft



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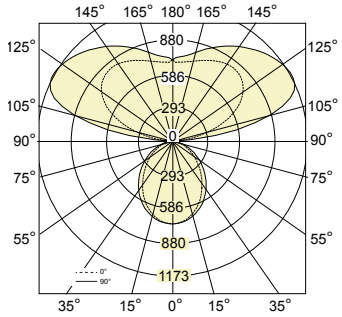

Lumen/ft up: 400 lm/ft
Lumen/ft down: 1600 lm/ft
Total Lumens: 6000 lm (for 4ft)
Input Watts: 54.05 W
Efficacy: 111 lm/W
IES FILE: TB2DILED-1100-400-80-35-SL-SO-4.IES

TESTED ACCORDING TO IES LM-79-2008

CANDELA DISTRIBUTION

Vertical Angle	Horizontal Angles 0	22.5	45	67.5	90
0	710	710	710	710	710
5	704	704	705	706	706
15	652	654	660	667	669
25	560	565	580	594	600
35	445	454	475	497	505
45	331	340	363	387	396
55	228	236	256	278	285
65	141	147	162	177	182
75	72	75	82	91	94
85	17	18	21	24	25
90	4	3	3	3	4
95	68	124	155	175	154
105	331	408	564	790	876
115	583	645	785	1020	1162
125	744	800	901	1061	1154
135	812	857	933	1032	1083
145	811	842	907	967	993
155	765	787	841	880	894
165	712	728	768	785	792
175	681	692	723	725	726
180	700	700	700	700	700

ZONAL LUMENS

Zone	Lumens
0	
0-10	67
10-20	186
20-30	267
30-40	297
40-50	280
50-60	230
60-70	161
70-80	88
80-90	25
90	
90-100	174
100-110	613
110-120	817
120-130	828
130-140	728
140-150	568
150-160	387
160-170	216
170-180	68
180	

LUMINANCE DATA (cd/m²)

Vertical Angle	Horizontal Angles 0	45	90
45	7795	8554	9323
55	6633	7444	8280
65	5577	6378	7182
75	4606	5299	6029
85	3275	3930	4866

All IES files for other lamping are available for download at: www.axislighting.com

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S2

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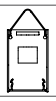
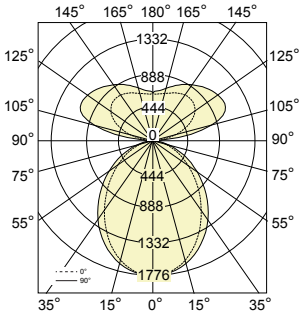
● *PHOTOMETRIC DATA*

SL SurroundLite - **Up**
SO spotless lens - **Down**

Uplight
1100 lm/ft
Downlight
1000 lm/ft



PHOTOMETRIC CURVE



Lumen/ft up: 1100 lm/ft
Lumen/ft down: 1000 lm/ft
Total Lumens: 8399 lm (for 4ft)
Input Watts: 75.6 W
Efficacy: 111 lm/W
IES FILE: TB2DILED1100-1000-80-35-SL-SO-4.IES

TESTED ACCORDING TO IES LM-79-2008

CANDELA DISTRIBUTION

Vertical Angle	Horizontal Angles 0	22.5	45	67.5	90
0	1776	1776	1776	1776	1776
5	1760	1760	1762	1764	1765
15	1630	1636	1651	1668	1673
25	1399	1414	1449	1486	1500
35	1113	1134	1188	1242	1263
45	827	850	908	968	989
55	571	591	641	694	713
65	354	368	404	443	455
75	179	186	206	227	234
85	43	45	51	60	64
90	5	3	4	4	6
95	68	124	155	175	154
105	331	408	564	790	876
115	583	645	785	1020	1162
125	744	800	901	1061	1154
135	812	857	933	1032	1083
145	811	842	907	967	993
155	765	787	841	880	894
165	712	728	768	785	792
175	681	692	723	725	726
180	700	700	700	700	700

ZONAL LUMENS

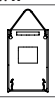
Zone	Lumens
0	
0-10	167
10-20	465
20-30	666
30-40	742
40-50	701
50-60	575
60-70	403
70-80	220
80-90	61
90	
90-100	174
100-110	613
110-120	817
120-130	828
130-140	728
140-150	568
150-160	387
160-170	216
170-180	68
180	

LUMINANCE DATA (cd/m²)

Vertical Angle	Horizontal Angles 0	45	90
45	19487	21386	23308
55	16583	18609	20700
65	13943	15945	17955
75	11515	13248	15073
85	8188	9825	12165

SL SurroundLite - **Up**
SO spotless lens - **Down**

Uplight
400 lm/ft
Downlight
1000 lm/ft



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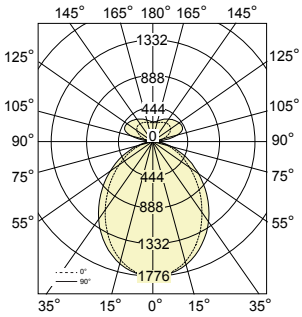

Lumen/ft up: 400 lm/ft
Lumen/ft down: 1000 lm/ft
Total Lumens: 5599 lm (for 4ft)
Input Watts: 50.4 W
Efficacy: 111 lm/W
IES FILE: TB2DILED-400-1000-80-35-SL-SO-4.IES

TESTED ACCORDING TO IES LM-79-2008

CANDELA DISTRIBUTION

Vertical Angle	Horizontal Angles 0	22.5	45	67.5	90
0	1776	1776	1776	1776	1776
5	1760	1760	1762	1764	1765
15	1630	1636	1651	1668	1673
25	1399	1414	1449	1486	1500
35	1113	1134	1188	1242	1263
45	827	850	908	968	989
55	571	591	641	694	713
65	354	368	404	443	455
75	179	186	206	227	234
85	43	45	51	60	64
90	3	2	3	2	4
95	25	45	56	64	56
105	121	148	205	287	319
115	212	235	286	371	422
125	270	291	328	386	420
135	295	312	339	375	394
145	295	306	330	352	361
155	278	286	306	320	325
165	259	265	279	285	288
175	248	252	263	264	264
180	254	254	254	254	254

ZONAL LUMENS

Zone	Lumens
0	
0-10	167
10-20	465
20-30	666
30-40	742
40-50	701
50-60	575
60-70	403
70-80	220
80-90	61
90	
90-100	63
100-110	223
110-120	297
120-130	301
130-140	265
140-150	207
150-160	141
160-170	79
170-180	25
180	

LUMINANCE DATA (cd/m²)

Vertical Angle	Horizontal Angles 0	45	90
45	19487	21386	23308
55	16583	18609	20700
65	13943	15945	17955
75	11515	13248	15073
85	8188	9825	12165

All IES files for other lamping are available for download at: www.axislighting.com

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S3

Cut sheet 1 of 2

ARCHIPELAGO LIGHTING
Lighting | Reinvented

NOSTALGIC
A19
COMMERCIAL GRADE

FILAMENT LED
60 Watt
REPLACEMENT

USES ONLY 7.5W

- NATURAL DIMMING – DIM TO OFF[2]
- SUITABLE FOR WET LOCATIONS
- ENCLOSED RATED
- 25,000 HOURS RATED LIFE
- 3-YEAR LIMITED WARRANTY
- 360° LIGHT DISTRIBUTION
- ENERGY STAR LISTED[3]
- UL LISTED

ALSO AVAILABLE IN:


SILVER-TIP


FROSTED

Ordering Information (A19, 60W)

Model Number	Type	Base	Lumens	Wattage	MOL I MOD	CCT	CRI
LTA19C80024MB	Glass I Clear	E26 I Medium	800LM	7.5W	4.1" I 2.4"	2400K	83
LTA19C80027MB	Glass I Clear	E26 I Medium	800LM	7.5W	4.1" I 2.4"	2700K	83
LTA19C80030MB	Glass I Clear	E26 I Medium	800LM	7.5W	4.1" I 2.4"	3000K	83
LTA19C80041MB	Glass I Clear	E26 I Medium	800LM	7.5W	4.1" I 2.4"	4100K	83
LTA19F80024MB	Glass I Frosted	E26 I Medium	800LM	7.5W	4.1" I 2.4"	2400K	83
LTA19F80027MB	Glass I Frosted	E26 I Medium	800LM	7.5W	4.1" I 2.4"	2700K	83
LTA19F80030MB	Glass I Frosted	E26 I Medium	800LM	7.5W	4.1" I 2.4"	3000K	83
LTA19F80041MB	Glass I Frosted	E26 I Medium	800LM	7.5W	4.1" I 2.4"	4100K	83
LTA19S80024MB	Glass I Silver	E26 I Medium	800LM	7.5W	4.1" I 2.4"	2400K	83
LTA19S80027MB	Glass I Silver	E26 I Medium	800LM	7.5W	4.1" I 2.4"	2700K	83

NOTE 1: Alternative CCTs are available as special order. Please contact sales@archipelagolighting.com for more information.
NOTE 2: Please reference dimmer compatibility list at www.archipelagolighting.com
NOTE 3: Please look for the Energy Star logo for listed products.

RoHS Pb ENERGY STAR PARTNER

ARCHIPELAGO LIGHTING, INC. I 4615 State Street, Montclair CA, 91763 I t: (866) 912-3220 I f: (909 627-2887

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Type

S3

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Cage Chandeliers

1080 - Small
1081 - Medium
1082 - Large
1084 - Mini

Project Name _____

Fixture Type _____

Quantity _____

Norwell | Lighting

ILEX

Custom Metalcraft

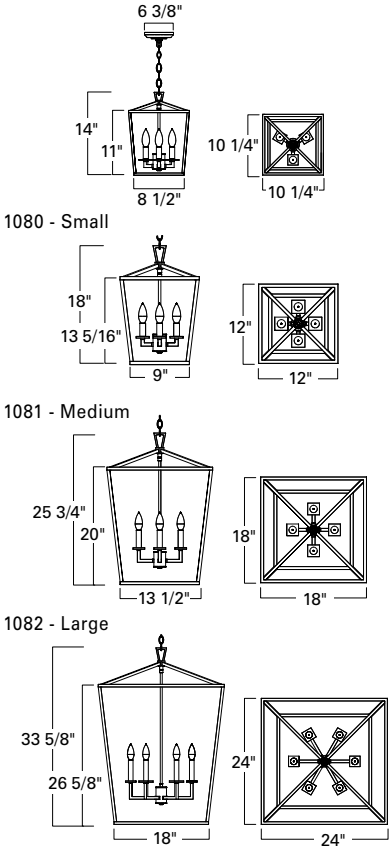
Cage Small
1080-PN-NG

Cage Medium
1081-MB-NG

Cage Large
1082-BR-NG

Cage Mini
1084-BR-NG

Also available in a Cage Linear Chandeliers.
See 1083 technical sheets



Product Name / Model / Dimensions	Finish Options	Glass	Lamping Options
Cage Small - 1080, Cage Medium - 1081, Cage Large - 1082, Cage Mini - 1084	Standard Matte Black / MB Polished Nickel / PN Powder Coat Bronze / BR	Standard None	LED 1082 - (6) 12 Watt Max per socket 1081 - (4) 12 Watt Max per socket 1080 - (4) 12 Watt Max per socket 1084 - (3) 12 Watt Max per socket LED replacement lamp only Standard Incandescent / IN 1082 - (6) 60 Watt Candelabra 1081 - (4) 60 Watt Candelabra 1080 - (4) 60 Watt Candelabra 1084 - (3) 60 Watt Candelabra

	Height	Width
1080	18"	12"
1081	25.75"	18"
1082	33.625"	24"
1084	14"	10.25"

Canopy - 6.375" Round on ALL Cage Lanterns
Provided with 6' chain and cord

UL/ETL Listed

REV-3-2020

DISCLAIMER:
Norwell Lighting and its companies, ILEX Architectural Lighting and Custom Metalcraft reserve the right to change specifications related to its product at anytime. USA Made indicates product is manufactured in East Taunton, Massachusetts facility. Phone: 508-823-1751

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ARCHIPELAGO LIGHTING
Lighting | Reinvented

TRUE COLORS

NOSTALGIC

CA10

COMMERCIAL GRADE

FILAMENT LED

40 Watt

REPLACEMENT

USES ONLY 3.5W

- NATURAL DIMMING – DIM TO OFF[2]
- SUITABLE FOR WET LOCATIONS
- ENCLOSED RATED
- 25,000 HOURS RATED LIFE
- 3-YEAR LIMITED WARRANTY
- 360° LIGHT DISTRIBUTION
- 90+CRI I JA8 COMPLIANT[3]
- ENERGY STAR LISTED[4]
- UL LISTED

ALSO AVAILABLE IN:

FROSTED

MEDIUM BASE

Ordering Information (CA10, 40W)

Model Number	Type	Base	Lumens	Wattage	MOL I MOD	CCT	CRI
LTCA10C35024CB	Glass I Clear	E12 I Candelabra	325LM	3.5W	4.0" I 1.3"	2400K	83
LTCA10C35027CB	Glass I Clear	E12 I Candelabra	325LM	3.5W	4.0" I 1.3"	2700K	83
LTCA10C35027CB-90	Glass I Clear	E26 I Medium	325LM	3.5W	3.5" I 1.3"	2700K	92+
LTCA10C35024MB	Glass I Clear	E26 I Medium	325LM	3.5W	3.5" I 1.3"	2400K	83
LTCA10C35027MB	Glass I Clear	E26 I Medium	325LM	3.5W	3.5" I 1.3"	2700K	83
LTCA10F35024CB	Glass I Frosted	E12 I Candelabra	325LM	3.5W	4.0" I 1.3"	2400K	83
LTCA10F35027CB	Glass I Frosted	E12 I Candelabra	325LM	3.5W	4.0" I 1.3"	2700K	83
LTCA10F35027CB-90	Glass I Frosted	E12 I Candelabra	325LM	3.5W	4.0" I 1.3"	2700K	92+
LTCA10F35024MB	Glass I Frosted	E26 I Medium	325LM	3.5W	3.5" I 1.3"	2400K	83
LTCA10F35027MB	Glass I Frosted	E26 I Medium	325LM	3.5W	3.5" I 1.3"	2700K	83

NOTE 1: Alternative CCTs are available as special order. Please contact sales@archipelagolighting.com for more information.
NOTE 2: Please reference dimmer compatibility list at www.archipelagolighting.com
NOTE 3: T.24 JA8 compliant products are designated with "-90" suffix for 90+CRI.
NOTE 4: Please look for the Energy Star logo for listed products.

RoHS

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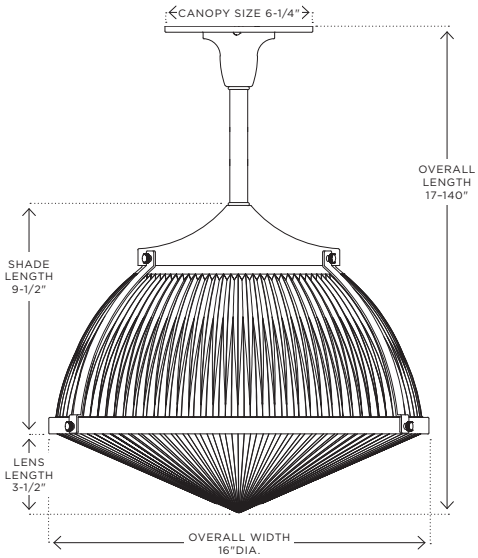


LAURELHURST 16″ PRISMATIC

CLASSIC PENDANT WITH 10 VARIATIONS

AVAILABLE SIZES:
A0042 - 16″ with Prismatic Dome
A0013 - 16″ with Prismatic Dome & Glass Lens (shown)

DETAILS

UL RATING: Damp

NUMBER OF SOCKETS: 1

MAX WATTAGE: 300W

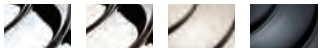
AVAILABLE SOCKET TYPES: Medium Base or GU24

LED OPTION: Available in all 16″ configurations

NUMBER OF AVAILABLE COMBINATIONS: 8

CONFIGURATION SHOWN: A0013 - Laurelhurst 16″ with Prismatic Dome & Glass Lens

FIXTURE FINISH



POLISHED CHROME | POLISHED NICKEL | BRUSHED NICKEL | OIL-RUBBED BRONZE

AVAILABLE CONFIGURATIONS

LAURELHURST 16″
WITH PRISMATIC DOME
A0042

LAURELHURST 16″
WITH PRISMATIC DOME
& GLASS LENS
A0013

REJUVENATION.COM

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Type

S5

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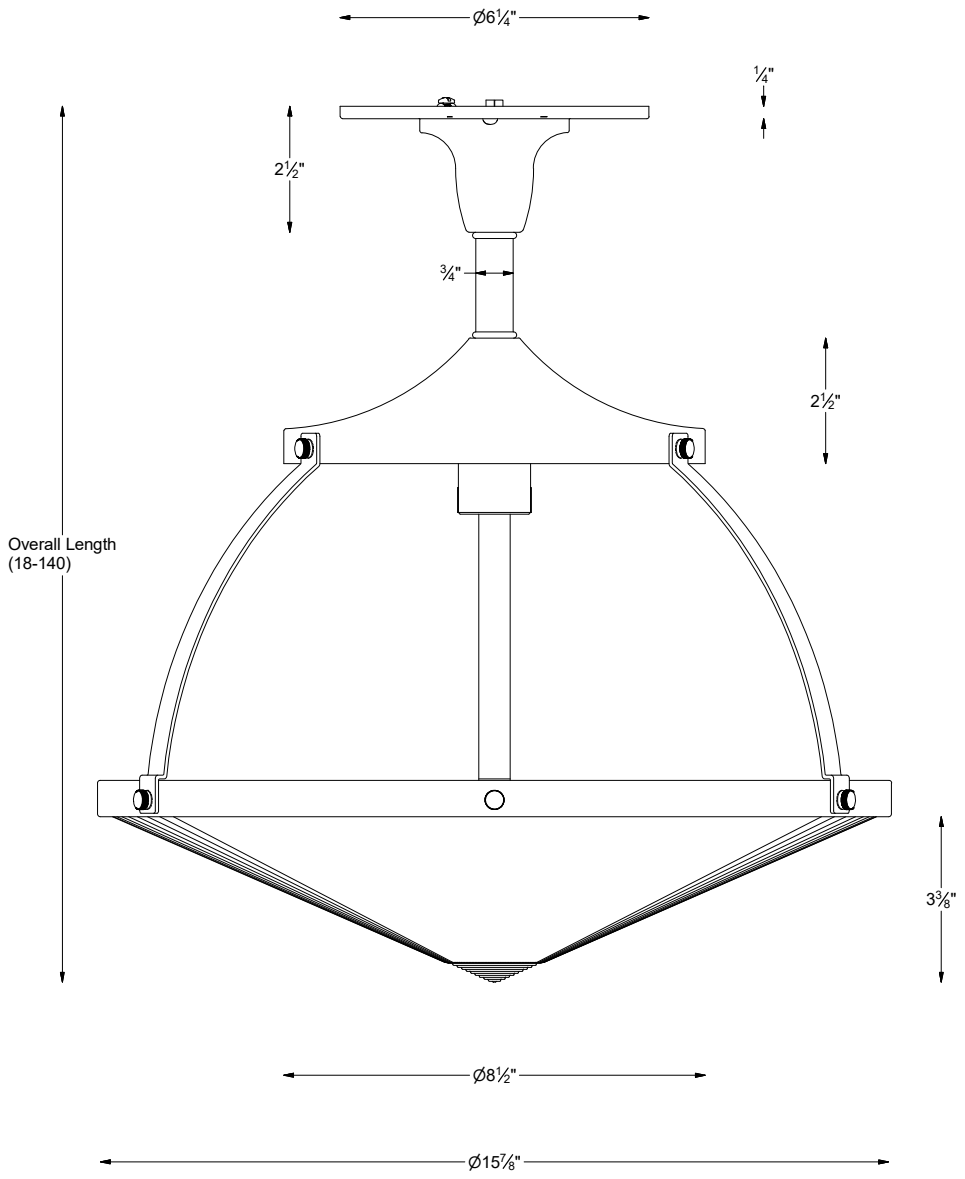

A0013

Laurelhurst pendant prismatic dome & lens 16 in

REJUVENATION

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Type

S5

Cut sheet 2 of 8

Project Name:	Type:
Part Number:	Date:

GREENCREATIVE

Value Select A Lamp Family

FEATURES

- Suitable to replace 40W, 60W, 75W, 100W Incandescent
- Comfortable diffused light
- Smooth dimming with existing dimmers*
- Suitable for use in damp locations
- Operating temperature: -4°F / -20°C to +95°F / +35°C
- Rated Lifetime (L70): 25,000hrs
- 3 year limited warranty

c UL us LISTED

ENERGY STAR

SPECIFICATIONS

Product	Model	Equiv.	Wattage (W)	CCT	Lumens	Efficacy (LPW)	Input Voltage	Beam Angle	CRI	Dim.*	Power Factor	Base	Fixture Rating	Lifetime (L70) (hrs)	Cert.
97985	6A19DIM/827/R	40W	6	2700K	480	80	120V	220°	82	Yes	0.9	E26	Non-Enclosed	25,000	ES
97986	6A19DIM/830/R	40W	6	3000K	480	80	120V	220°	82	Yes	0.9	E26	Non-Enclosed	25,000	ES
98011	8A19DIM/827/R	60W	8	2700K	800	100	120V	220°	82	Yes	0.9	E26	Non-Enclosed	25,000	ES
98012	8A19DIM/830/R	60W	8	3000K	800	100	120V	220°	82	Yes	0.9	E26	Non-Enclosed	25,000	ES
98013	8A19DIM/840/R	60W	8	4000K	800	100	120V	220°	82	Yes	0.9	E26	Non-Enclosed	25,000	ES
97908	9A19DIM/827/GU24/R	60W	9	2700K	800	89	120V	240°	82	Yes	0.9	GU24	Enclosed	25,000	ES
97909	9A19DIM/830/GU24/R	60W	9	3000K	820	91	120V	240°	82	Yes	0.9	GU24	Enclosed	25,000	ES
97910	9A19DIM/840/GU24/R	60W	9	4000K	860	96	120V	240°	82	Yes	0.9	GU24	Enclosed	25,000	ES
98138	11A19DIM/827	75W	11	2700K	1100	100	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98139	11A19DIM/830	75W	11	3000K	1150	105	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98140	11A19DIM/840	75W	11	4000K	1200	109	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98144	15A21DIM/827	100W	15	2700K	1600	107	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98145	15A21DIM/830	100W	15	3000K	1650	110	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98146	15A21DIM/840	100W	15	4000K	1700	113	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98150	15A21DIM/827/GU24	100W	15	2700K	1600	107	120V	240°	82	Yes	0.9	GU24	Enclosed	25,000	ES
98083	14A19/827/3WAY	40W 60W 100W	4 8 14	2700K	500 1000 1500	125 125 107	120V	230°	82	No	0.9	E26d	Non-Enclosed	15,000	ES

* This lamp might not be compatible with all dimmers. Please visit www.greencreative.com for compatibility information.

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S5

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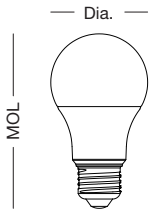
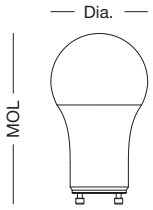
Value Select A Lamp Family

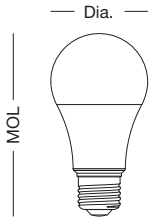
DIMENSIONS & WEIGHT



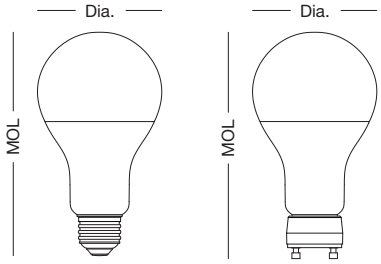
Model	Base	MOL	Dia.	Weight
6A19DIM/xxx/R	E26	4-3/16”	2-3/8”	0.07lb
8A19DIM/xxx/R	E26	4-3/16”	2-3/8”	0.08lb



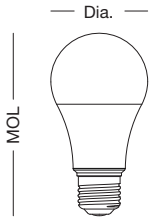
Model	Base	MOL	Dia.	Weight
9A19DIM/xxx/GU24/R	GU24	4-3/16”	2-3/8”	0.11lb



Model	Base	MOL	Dia.	Weight
11A19DIM/xxx	E26	4-7/16”	2-3/8”	0.13lb



Model	Base	MOL	Dia.	Weight
15A21DIM/xxx	E26	5-7/16”	3”	0.23lb
15A21/xxx/GU24	GU24	5-1/2”	3”	0.26lb



Model	Base	MOL	Dia.	Weight
14A19/xxx/3WAY	E26d	4-5/8”	2-3/8”	0.25lb

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Cut sheet 4 of 8

GREENCREATIVE

Value Select A Lamp Family

MINIMUM COMPARTMENT DIMENSIONS		
Model	Diameter	Height
6A19DIM/xxx/R	6”	8-1/2”
8A19DIM/xxx/R	6”	8-1/2”
9A19DIM/xxx/GU24/R	6”	8-1/2”
11A19DIM/xxx	6”	8-1/2”
15A21DIM/xxx	6”	8-1/2”
15A21/xxx/GU24	6”	8-1/2”
14A19/xxx/3WAY	6”	8-1/2”

Installing lamp in a fixture that does not have the minimum compartment dimensions will void the warranty and could cause product failures.

080819

GREENCREATIVE

Value Select A Lamp Family

MODEL

Model: 6A19DIM/xxx/R
8A19DIM/xxx/R
9A19DIM/xxx/GU24/R
11A19DIM/xxx
15A21DIM/xxx
15A21DIM/xxx/GU24
Where xxx means 824-965 which indicates CRI and color temperature

DIMMER COMPATIBILITY

Model: 6A19DIM/xxx/R

Brand	Series	Model	Load (W)	Dimming Range	Dimmability
Lutron	Diva	DV-600P	600	10-100%	Compatible
	Toggler	TG-600P	600	-	Not Compatible
	Skylark Contour	CTCL-153P	150	10-80%	Compatible
	Toggler	TGCL-153P	150	10-100%	Compatible
	Diva	DVCL-153P	150	10-100%	Compatible
	Maestro C•L	MACL-153M	150	10-100%	Compatible
	Ariadni	AYCL-153P	150	10-100%	Compatible
Leviton	Sureslide Decora	6674	600	10-100%	Compatible
	Trimatron	6602	600	-	Not Compatible
Cooper	Aspire	9534	300	-	Not Compatible

DIMMER COMPATIBILITY

Model: 8A19DIM/xxx/R

Brand	Series	Model	Load (W)	Dimming Range	Dimmability
Lutron	Diva	DV-600P	600	0-100%	Compatible
	Toggler	TG-600P	600	-	Not Compatible
	Skylark Contour	CTCL-153P	150	-	Not Compatible
	Toggler	TGCL-153P	150	0-100%	Compatible
	Diva	DVCL-153P	150	0-100%	Compatible
	Maestro C•L	MACL-153M	150	-	Not Compatible
	Ariadni	AYCL-153P	150	0-100%	Compatible
Leviton	Sureslide Decora	6674	600	0-100%	Compatible
	Trimatron	6602	600	-	Not Compatible
Cooper	Aspire	9534	300	-	Not Compatible

GREENCREATIVE

Value Select A Lamp Family

DIMMER COMPATIBILITY

Model: 9A19DIM/xxx/GU24/R

Brand	Series	Model	Load (W)	Dimming Range	Dimmability
Lutron	Diva	DV-600P	600	0-100%	Compatible
	Toggler	TG-600P	600	-	Not Compatible
	Skylark Contour	CTCL-153P	150	0-100%	Compatible
	Toggler	TGCL-153P	150	0-100%	Compatible
	Diva	DVCL-153P	150	0-100%	Compatible
	Maestro C•L	MACL-153M	150	-	Compatible
	Ariadni	AYCL-153P	150	0-100%	Compatible
Leviton	Sureslide Decora	6674	600	0-100%	Compatible
	Trimatron	6602	600	-	Not Compatible
Cooper	Aspire	9534	600	-	Not Compatible

DIMMER COMPATIBILITY

Model: 11A19DIM/xxx

Brand	Series	Model	Load (W)	Dimming Range	Dimmability
Lutron	Diva	DV-600P	600	0-100%	Compatible
	Toggler	TG-600P	600	-	Not Compatible
	Skylark Contour	CTCL-153P	150	0-100%	Compatible
	Toggler	TGCL-153P	150	0-100%	Compatible
	Diva	DVCL-153P	150	0-100%	Compatible
	Maestro C•L	MACL-153M	150	0-100%	Compatible
	Ariadni	AYCL-153P	150	0-100%	Compatible
Leviton	Sureslide Decora	6674	600	0-100%	Compatible
	Trimatron	6602	600	10-100%	Compatible
Cooper	Aspire	9534	600	-	Not Compatible

GREENCREATIVE

Value Select A Lamp Family

DIMMER COMPATIBILITY

Model: 15A21DIM/xxx 15A21DIM/xxx/GU24

Brand	Series	Model	Load (W)	Dimming Range	Dimmability
Lutron	Diva	DV-600P	600	0-100%	Compatible
	Toggler	TG-600P	600	-	Not Compatible
	Skylark Contour	CTCL-153P	150	0-100%	Compatible
	Toggler	TGCL-153P	150	0-100%	Compatible
	Diva	DVCL-153P	150	0-100%	Compatible
	Maestro C•L	MACL-153M	150	0-100%	Compatible
	Ariadni	AYCL-153P	150	0-100%	Compatible
Leviton	Sureslide Decora	6674	600	0-100%	Compatible
	Trimatron	6602	600	10-100%	Compatible
Cooper	Aspire	9534	600	-	Not Compatible

GREEN CREATIVE has provided this dimmer switch compatibility chart for guidance when selecting a dimmer and lamp combination. Our lamps were tested for compatibility with the above listed dimmers. Dimmers that do not appear on the chart might still be compatible but have not been tested. All testing has been performed with a stable main supply. The quality of the local main, existing installation and wiring, as well as different manufacturer versions of the above dimmers may affect dimming performance. Since no assurance can be provided regarding these factors, it is a general recommendation to perform a test on-site prior to installing the LED lamps.

REJUVENATION

Eastmoreland 6" Fitter Pendant

Item #A6911

http://www.rejuvenation.com/s/1bow2

Specification	Detail
Item #	A6911
Finish	Oil-Rubbed Bronze
Length	32"
Socket type	E26
Min Length	16"
Max Length	145"
Shade	B0262-14 in-OP
Shade SKU	B0262-14 in-OP
Max Wattage	150 W
UL Listed	UL Listed
UL Location	Damp
Canopy	6-1/2"
Overall Width	14"
Shade height	6"

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S6

Cut sheet 1 of 7

Project Name:	Type:
Part Number:	Date:

GREENCREATIVE

Value Select A Lamp Family

FEATURES

- Suitable to replace 40W, 60W, 75W, 100W Incandescent
- Comfortable diffused light
- Smooth dimming with existing dimmers*
- Suitable for use in damp locations
- Operating temperature: -4°F / -20°C to +95°F / +35°C
- Rated Lifetime (L70): 25,000hrs
- 3 year limited warranty

c UL us LISTED

ENERGY STAR

SPECIFICATIONS

Product	Model	Equiv.	Wattage (W)	CCT	Lumens	Efficacy (LPW)	Input Voltage	Beam Angle	CRI	Dim.*	Power Factor	Base	Fixture Rating	Lifetime (L70) (hrs)	Cert.
97985	6A19DIM/827/R	40W	6	2700K	480	80	120V	220°	82	Yes	0.9	E26	Non-Enclosed	25,000	ES
97986	6A19DIM/830/R	40W	6	3000K	480	80	120V	220°	82	Yes	0.9	E26	Non-Enclosed	25,000	ES
98011	8A19DIM/827/R	60W	8	2700K	800	100	120V	220°	82	Yes	0.9	E26	Non-Enclosed	25,000	ES
98012	8A19DIM/830/R	60W	8	3000K	800	100	120V	220°	82	Yes	0.9	E26	Non-Enclosed	25,000	ES
98013	8A19DIM/840/R	60W	8	4000K	800	100	120V	220°	82	Yes	0.9	E26	Non-Enclosed	25,000	ES
97908	9A19DIM/827/GU24/R	60W	9	2700K	800	89	120V	240°	82	Yes	0.9	GU24	Enclosed	25,000	ES
97909	9A19DIM/830/GU24/R	60W	9	3000K	820	91	120V	240°	82	Yes	0.9	GU24	Enclosed	25,000	ES
97910	9A19DIM/840/GU24/R	60W	9	4000K	860	96	120V	240°	82	Yes	0.9	GU24	Enclosed	25,000	ES
98138	11A19DIM/827	75W	11	2700K	1100	100	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98139	11A19DIM/830	75W	11	3000K	1150	105	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98140	11A19DIM/840	75W	11	4000K	1200	109	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98144	15A21DIM/827	100W	15	2700K	1600	107	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98145	15A21DIM/830	100W	15	3000K	1650	110	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98146	15A21DIM/840	100W	15	4000K	1700	113	120V	240°	82	Yes	0.9	E26	Enclosed	25,000	ES
98150	15A21DIM/827/GU24	100W	15	2700K	1600	107	120V	240°	82	Yes	0.9	GU24	Enclosed	25,000	ES
98083	14A19/827/3WAY	40W 60W 100W	4 8 14	2700K	500 1000 1500	125 125 107	120V	230°	82	No	0.9	E26d	Non-Enclosed	15,000	ES

* This lamp might not be compatible with all dimmers. Please visit www.greencreative.com for compatibility information.

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Type

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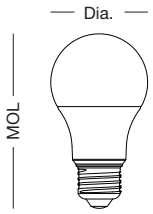
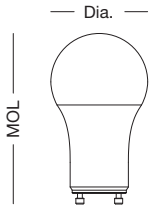
Cut sheet 2 of 7

Value Select A Lamp Family

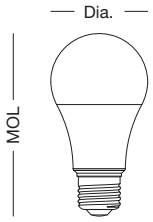
DIMENSIONS & WEIGHT



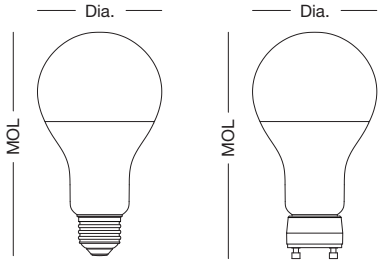
Model	Base	MOL	Dia.	Weight
6A19DIM/xxx/R	E26	4-3/16”	2-3/8”	0.07lb
8A19DIM/xxx/R	E26	4-3/16”	2-3/8”	0.08lb



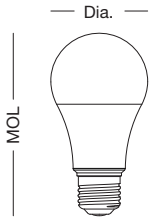
Model	Base	MOL	Dia.	Weight
9A19DIM/xxx/GU24/R	GU24	4-3/16”	2-3/8”	0.11lb



Model	Base	MOL	Dia.	Weight
11A19DIM/xxx	E26	4-7/16”	2-3/8”	0.13lb



Model	Base	MOL	Dia.	Weight
15A21DIM/xxx	E26	5-7/16”	3”	0.23lb
15A21/xxx/GU24	GU24	5-1/2”	3”	0.26lb



Model	Base	MOL	Dia.	Weight
14A19/xxx/3WAY	E26d	4-5/8”	2-3/8”	0.25lb

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Cut sheet 3 of 7

GREENCREATIVE

Value Select A Lamp Family

MINIMUM COMPARTMENT DIMENSIONS		
Model	Diameter	Height
6A19DIM/xxx/R	6”	8-1/2”
8A19DIM/xxx/R	6”	8-1/2”
9A19DIM/xxx/GU24/R	6”	8-1/2”
11A19DIM/xxx	6”	8-1/2”
15A21DIM/xxx	6”	8-1/2”
15A21/xxx/GU24	6”	8-1/2”
14A19/xxx/3WAY	6”	8-1/2”

Installing lamp in a fixture that does not have the minimum compartment dimensions will void the warranty and could cause product failures.

080819

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GREENCREATIVE

Value Select A Lamp Family

MODEL

Model: 6A19DIM/xxx/R
8A19DIM/xxx/R
9A19DIM/xxx/GU24/R
11A19DIM/xxx
15A21DIM/xxx
15A21DIM/xxx/GU24
Where xxx means 824-965 which indicates CRI and color temperature

DIMMER COMPATIBILITY

Model: 6A19DIM/xxx/R

Brand	Series	Model	Load (W)	Dimming Range	Dimmability
Lutron	Diva	DV-600P	600	10-100%	Compatible
	Toggler	TG-600P	600	-	Not Compatible
	Skylark Contour	CTCL-153P	150	10-80%	Compatible
	Toggler	TGCL-153P	150	10-100%	Compatible
	Diva	DVCL-153P	150	10-100%	Compatible
	Maestro C•L	MACL-153M	150	10-100%	Compatible
	Ariadni	AYCL-153P	150	10-100%	Compatible
Leviton	Sureslide Decora	6674	600	10-100%	Compatible
	Trimatron	6602	600	-	Not Compatible
Cooper	Aspire	9534	300	-	Not Compatible

DIMMER COMPATIBILITY

Model: 8A19DIM/xxx/R

Brand	Series	Model	Load (W)	Dimming Range	Dimmability
Lutron	Diva	DV-600P	600	0-100%	Compatible
	Toggler	TG-600P	600	-	Not Compatible
	Skylark Contour	CTCL-153P	150	-	Not Compatible
	Toggler	TGCL-153P	150	0-100%	Compatible
	Diva	DVCL-153P	150	0-100%	Compatible
	Maestro C•L	MACL-153M	150	-	Not Compatible
	Ariadni	AYCL-153P	150	0-100%	Compatible
Leviton	Sureslide Decora	6674	600	0-100%	Compatible
	Trimatron	6602	600	-	Not Compatible
Cooper	Aspire	9534	300	-	Not Compatible

GREENCREATIVE

Value Select A Lamp Family

DIMMER COMPATIBILITY

Model: 9A19DIM/xxx/GU24/R

Brand	Series	Model	Load (W)	Dimming Range	Dimmability
Lutron	Diva	DV-600P	600	0-100%	Compatible
	Toggler	TG-600P	600	-	Not Compatible
	Skylark Contour	CTCL-153P	150	0-100%	Compatible
	Toggler	TGCL-153P	150	0-100%	Compatible
	Diva	DVCL-153P	150	0-100%	Compatible
	Maestro C•L	MACL-153M	150	-	Compatible
	Ariadni	AYCL-153P	150	0-100%	Compatible
Leviton	Sureslide Decora	6674	600	0-100%	Compatible
	Trimatron	6602	600	-	Not Compatible
Cooper	Aspire	9534	600	-	Not Compatible

DIMMER COMPATIBILITY

Model: 11A19DIM/xxx

Brand	Series	Model	Load (W)	Dimming Range	Dimmability
Lutron	Diva	DV-600P	600	0-100%	Compatible
	Toggler	TG-600P	600	-	Not Compatible
	Skylark Contour	CTCL-153P	150	0-100%	Compatible
	Toggler	TGCL-153P	150	0-100%	Compatible
	Diva	DVCL-153P	150	0-100%	Compatible
	Maestro C•L	MACL-153M	150	0-100%	Compatible
	Ariadni	AYCL-153P	150	0-100%	Compatible
Leviton	Sureslide Decora	6674	600	0-100%	Compatible
	Trimatron	6602	600	10-100%	Compatible
Cooper	Aspire	9534	600	-	Not Compatible

GREENCREATIVE

Value Select A Lamp Family

DIMMER COMPATIBILITY

Model: 15A21DIM/xxx 15A21DIM/xxx/GU24

Brand	Series	Model	Load (W)	Dimming Range	Dimmability
Lutron	Diva	DV-600P	600	0-100%	Compatible
	Toggler	TG-600P	600	-	Not Compatible
	Skylark Contour	CTCL-153P	150	0-100%	Compatible
	Toggler	TGCL-153P	150	0-100%	Compatible
	Diva	DVCL-153P	150	0-100%	Compatible
	Maestro C•L	MACL-153M	150	0-100%	Compatible
	Ariadni	AYCL-153P	150	0-100%	Compatible
Leviton	Sureslide Decora	6674	600	0-100%	Compatible
	Trimatron	6602	600	10-100%	Compatible
Cooper	Aspire	9534	600	-	Not Compatible

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LITHONIA LIGHTING®

Catalog Number	
Notes	
Type	

FEATURES & SPECIFICATIONS

INTENDED USE

Provides years of maintenance-free illumination for indoor or outdoor use in residential & commercial applications.

CONSTRUCTION

Cast-aluminum housing with corrosion-resistant paint in an industrial grey finish.

Sealed gasket protects against moisture and dust.

OPTICS

4000K CCT LEDs.

Frosted glass diffuser provides even light distribution.

LUMEN MAINTENANCE

LEDs will deliver 70% of their initial lumens at 50,000 hour average LED life. See Lighting Facts label on page 2 for performance details.

ELECTRICAL

MVOLT driver operates on any line voltage from 120-277V

Operating temperature -40ºC to 40ºC.

4kV surge protection standard.

INSTALLATION

Mounts to ceiling or wall with surface mount junction box (included).

LISTINGS

UL Listed to U.S. and Canadian safety standards for wet locations.

Tested in accordance with IESNA LM-79 and LM-80 standards.

WARRANTY

Five-year limited warranty. Full warranty terms located at www.AcuityBrands.com/CustomerResources/Terms_and_Conditions.aspx

Note: Actual performance may differ as a result of end-user environment and application.

All values are design or typical values, measured under laboratory conditions at 25 °C.

Specifications are subject to change without notice.

Outdoor General Purpose

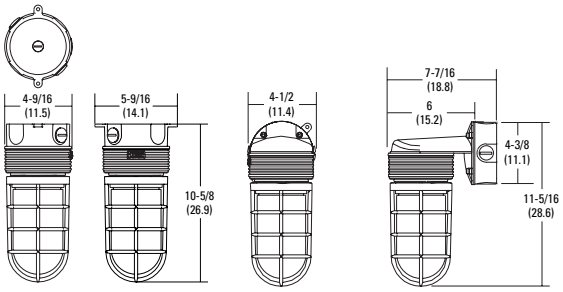
OLVTCM & OLVTWM

LED VAPORTIGHT

LED

Specifications

All dimensions are inches (centimeters)



ORDERING INFORMATION For shortest lead times, configure products using **bolded options**.

Example: OLVTCM

Series	Color temperature	Voltage	Finish
OLVTCM Ceiling MT **OLVTWM** Wall MT	**(blank)** 4000K	**(blank)** MVOLT (120V-277V)	**(blank)** Grey

Series	System Wattange	Lumens
OLVTCM	15W	600
OLVTWM	15W	600

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Construction Document

Type

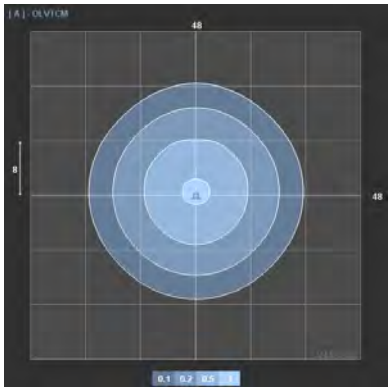
W1

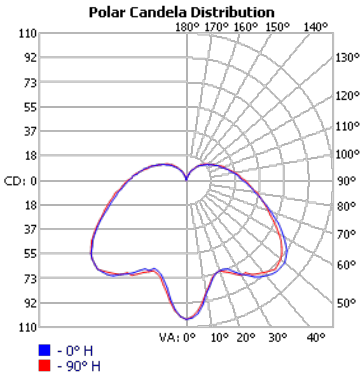
Cut sheet 1 of 2

PHOTOMETRICS

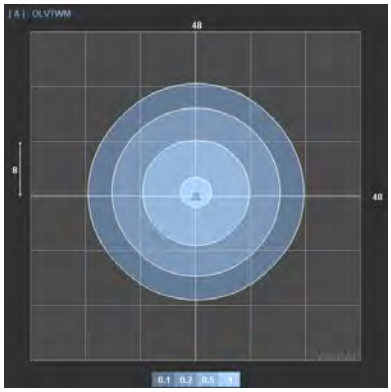
To see complete photometric reports or download .ies files for this product,visit Lithonia Lighting's Outdoor LED homepage
Tested in accordance with IESNA LM-79 and LM-80 standards.

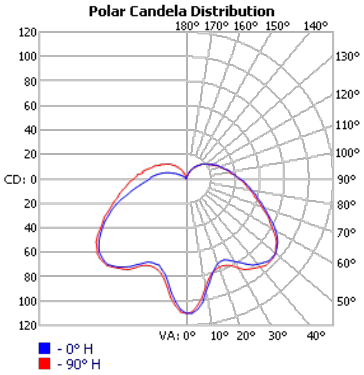
OLVTCM





OLVTWM





LITHONIA LIGHTING®
An Acuity Brands Company

DECORATIVE INDOOR & OUTDOOR: One Lithonia Way Conyers, GA 30012 Phone: 1-800-705-SERV (7378) www.lithonia.com

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Type

W1

Cut sheet 2 of 2

Royal Marine™ 1 Light 13.25" Wall Light Distressed Black

49126DBK

SPECIFICATIONS

Certifications/Qualifications	
	www.kichler.com/warranty
Dimensions	
Base Backplate	4.50 X 7.00
Extension	9.25"
Weight	4.00 LBS
Height from center of Wall opening (Spec Sheet)	5.50"
Height	13.25"
Width	7.00"
Light Source	
Lamp Included	Not Included
Lamp Type	A19
Light Source	Incandescent
Max or Nominal Watt	100W
# of Bulbs/LED Modules	1
Socket Type	Medium
Socket Wire	150"
Mounting/Installation	
Interior/Exterior	Exterior
Location Rating	Wet
Mounting Style	Wall Mount
Mounting Weight	3.00 LBS

FIXTURE ATTRIBUTES

Housing	
Diffuser Description	Clear Seeded
Primary Material	ALUMINUM
Product/Ordering Information	
SKU	49126DBK
Finish	Distressed Black
Style	Coastal
UPC	783927511964
Finish Options	
Distressed Black	

ALSO IN THIS FAMILY

49145DBK

49127DBK

49128DBK

49129DBK

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Type

W2

Cut sheet 1 of 2

ARCHIPELAGO LIGHTING
Lighting | Reinvented

NOSTALGIC

A19

COMMERCIAL GRADE

FILAMENT LED

40 Watt

REPLACEMENT

USES ONLY 4.5W

- NATURAL DIMMING – DIM TO OFF[2]
- SUITABLE FOR WET LOCATIONS
- ENCLOSED RATED
- 25,000 HOURS RATED LIFE
- 3-YEAR LIMITED WARRANTY
- 360° LIGHT DISTRIBUTION
- ENERGY STAR LISTED[3]
- UL LISTED

ALSO AVAILABLE IN:

SILVER-TIP

FROSTED

Ordering Information (A19, 40W)

Model Number	Type	Base	Lumens	Wattage	MOL I MOD	CCT	CRI
LTA19C50024MB	Glass I Clear	E26 I Medium	500LM	4.5W	4.1" I 2.4"	2400K	83
LTA19C50027MB	Glass I Clear	E26 I Medium	500LM	4.5W	4.1" I 2.4"	2700K	83
LTA19C50030MB	Glass I Clear	E26 I Medium	500LM	4.5W	4.1" I 2.4"	3000K	83
LTA19C50041MB	Glass I Clear	E26 I Medium	500LM	4.5W	4.1" I 2.4"	4100K	83
LTA19F50024MB	Glass I Frosted	E26 I Medium	450LM	4.5W	4.1" I 2.4"	2400K	83
LTA19F50027MB	Glass I Frosted	E26 I Medium	450LM	4.5W	4.1" I 2.4"	2700K	83
LTA19F50030MB	Glass I Frosted	E26 I Medium	450LM	4.5W	4.1" I 2.4"	3000K	83
LTA19F50041MB	Glass I Frosted	E26 I Medium	450LM	4.5W	4.1" I 2.4"	4100K	83
LTA19S50024MB	Glass I Silver	E26 I Medium	500LM	4.5W	4.1" I 2.4"	2400K	83
LTA19S50027MB	Glass I Silver	E26 I Medium	500LM	4.5W	4.1" I 2.4"	2700K	83

NOTE 1: Alternative CCTs are available as special order. Please contact *sales@archipelagolighting.com* for more information.
NOTE 2: Please reference dimmer compatibility list at *www.archipelagolighting.com*
NOTE 3: Please look for the Energy Star logo for listed products.

RoHS Pb ENERGY STAR PARTNER

ARCHIPELAGO LIGHTING, INC. I 4615 State Street, Montclair CA, 91763 I t: (866) 912-3220 I f: (909 627-2887

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LITHONIA LIGHTING®

Catalog Number	
Notes	
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DIGITAL NAVIGATION

Ordering Tree nLight Platform Sensor Switch JOT Photometrics Performance Data

FEATURES & SPECIFICATIONS

INTENDED USE — The BLWP LED Wrap/ Wall bracket expands the BLT family with the features and aesthetics of the popular BLT and BLTR center basket design with a clean, versatile style and volumetric distribution. High efficacy LED light engines deliver energy savings and low maintenance compared to traditional sources. An extensive selection of configurations and options make the BLWP the perfect choice for many lighting applications including schools, offices, stairwells and other commercial spaces. With multiple mounting options, easy installation, and controls configurations, the BLWP is an excellent choice for renovation and new construction.

CONSTRUCTION — BLWP enclosure components are die-formed for dimensional consistency. For 2' and 4' product, hinged door frame allows easy access to electrical components and mounting locations without having to remove additional parts. For 8' product, suspension aircraft cables allow easy access to electrical components and mounting locations without having to remove additional parts. Available in three paint finishes: white (pre-paint), painted after fabrication white, and natural aluminum. Diffusers are extruded from impact modified acrylic for increased durability. Optional polycarbonate lens available for additional impact resistance, as well as Tamper Proof screws.

OPTICS — Volumetric illumination is achieved by creating an optimal mix of light to walls, partitions and vertical and horizontal work surfaces – rendering the interior space, objects and occupants in a more balanced, complimentary luminous environment. High performance extruded acrylic diffusers conceal LEDs and efficiently deliver light in a volumetric distribution. Five diffuser choices available - curved and square designs with ribbed, a smooth frosted finish, and a smooth polycarbonate finish.

ELECTRICAL — Long-life LEDs, coupled with high-efficiency drivers, provide superior quantity and qualityof illumination for extended service life. 80% LED lumen maintenance at 60,000 hours (L80/60,000). Replaces 2 lamp fluorescent.

Configurable BLWP: Available in High Efficiency (HE) versions for applications where a lower wattage (over the standard product) is required. The High Efficiency versions deliver >130 LPW and can be specified via the Lumen Package designations in the Ordering Information on page 2.

eldoLED driver options deliver choice of dimming range, and choices for control, while assuring flicker-free, low-current inrush, 89% efficiency and low EMI.

Optional integrated nLight® controls make each luminaire addressable - allowing it to digitally communicate with other nLight enabled controls such as dimmers, switches, occupancy sensors and photocontrols. Connection to nLight is simple. It can be accomplished with integrated nLight AIR wireless or through standard Cat-5 cabling. nLight offers unique plug-and-play convenience as devices and luminaires automatically discover each other and self-commission, while nLight AIR is commissioned easily through an intuitive mobile app.

Lumen Management: Unique lumen management system (option N80) provides on board intelligence that actively manages the LED light source so that constant lumen output is maintained over the system life, preventing the energy waste created by the traditional practice of over-lighting.

Driver disconnect provided where required to comply with US and Canadian codes.

CONTROLS — **Integrated sensor (individual control):** Sensor Switch MSD7ADCX (Passive infrared (PIR)) or MSDPDT7ADCX (PIR/Microphonics Dual Tech (PDT)) integrated occupancy sensor/automatic dimming photocell allows the luminaire to power off when the space is unoccupied or enough ambient light is entering the space.

Integrated Sensor (nLight Wired Networking): This sensor is nLight-enabled, meaning it has the ability to communicate over an nLight network. When wired, using CAT-5 cabling, with other nLight-enabled sensors, power packs, or WallPods, an nLight control zone is created. Once linked to a Gateway, directly or via a Bridge, the zone becomes capable of remote status monitoring and control via SensorView software. See page 5 for the nLight sensor options.

Integrated Smart Sensor (nLight AIR Wireless Platform): The rES7 sensor is nLight AIR enabled, meaning it has the ability to communicate over the wireless nLight control platform. It is available with an automatic dimming photocell, and either a digital PIR or dual technology occupancy sensor. It pairs to other luminairs and wall switches through our mobile app, CL***AIR***ITY PRO, which allows for simple sensor adjustment. See page 5 for more details on the Integrated Smart Sensor.

Integrated Wireless Sensor (single room control): Sensor Switch VERTEX JOT or JOTVTX15 luminaire-embedded occupancy and ambient light sensor allows the luminaire to power off when the space is unoccupied or when enough ambient light is entering the space. See page X for more details on the integrated wireless sensor.

INSTALLATION — Intended for surface or suspend mounting. For row mounting and quick mounting to junction boxes see accessories section. Suitable for damp location.

LISTINGS — CSA Certified to meet U.S. and Canadian standards.

DesignLights Consortium® (DLC) Premium qualified product. Not all versions of this product may be DLC Premium qualified. Please check the DLC Qualified Products List at www.designlights.org/QPL to confirm which versions are qualified.

BUY AMERICAN — Product with the BAA option is assembled in the USA and meets the Buy America(n) government procurement requirements under FAR, DFARS and DOT. Please refer to www.acuitybrands.com/buy-american for additional information.

WARRANTY — 5-year limited warranty. Complete warranty terms located at: www.acuitybrands.com/support/warranty/terms-and-conditions

Note: Actual performance may differ as a result of end-user environment and application. All values are design or typical values, measured under laboratory conditions at 25 °C. Specifications subject to change without notice.

Low Profile LED Wraparound

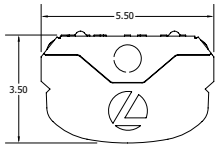
BLWP

2', 4' and 8' Lengths

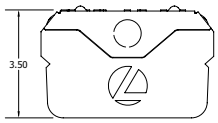
eldoLED your product | our drive · DLC PREMIUM · A+ CAPABLE · LED · nLIGHT · Buy American · JOT JUST ONE TOUCH

Specifications

2' Dimensions
Length: 24 (60.96)
Width: 5.50 (13.97)
Depth: 3.50 (8.89)



4' Dimensions
Length: 48 (121.92)
Width: 5.50 (13.97)
Depth: 3.50 (8.89)



8' Dimensions
Length: 96 (243.84)
Width: 5.50 (13.97)
Depth: 3.50 (8.89)

All dimensions are inches (centimeters) unless otherwise specified.

A+ Capable Luminaire

This item is an A+ capable luminaire, which has been designed and tested to provide consistent color appearance and out-of-the-box control compatibility with simple commissioning.

- All configurations of this luminaire meet the Acuity Brands' specification for chromatic consistency
- This luminaire is part of an A+ Certified solution for nLight® or control networks marked by a shaded background*
- This luminaire is part of an A+ Certified solution for nLight control networks, providing advanced control functionality at the luminaire level, when selection includes driver and control options marked by a shaded background*

To learn more about A+, visit www.acuitybrands.com/aplus.

*See ordering tree for details

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A+ Capable options indicated by this color background.

ORDERING INFORMATION Lead times will vary depending on options selected. Consult with your sales representative.

Example: BLWP4 40L ADP GZ10 LP840

Series	Lumens ‡ Standard Efficiency (>100 LPW)		High Efficiency ‡ (>130 LPW)	
BLWP2 2' LED Wraparound	8L	800 Lumens	8LHE	800 Lumens
	20L	2000 Lumens	20LHE	2000 Lumens
	33L	3300 Lumens	33LHE	3300 Lumens
	40L	4000 Lumens	40LHE	4000 Lumens
	48L	4800 Lumens	48LHE	4800 Lumens
BLWP4 4' LED Wraparound	15L	1500 Lumens	15LHE	1500 Lumens
	20L	2000 Lumens	20LHE	2000 Lumens
	30L	3000 Lumens	30LHE	3000 Lumens
	40L	4000 Lumens	40LHE	4000 Lumens
	48L	4800 Lumens	48LHE	4800 Lumens
	60L	6000 Lumens	60LHE	6000 Lumens
	72L	7200 Lumens	72LHE	7200 Lumens
	85L	8500 Lumens	85LHE	8500 Lumens
	100L	10000 Lumens	100LHE	10000 Lumens
BLWP8 8' LED Wraparound	40L	4000 Lumens	40LHE	4000 Lumens
	60L	6000 Lumens	60LHE	6000 Lumens
	80L	8000 Lumens	80LHE	8000 Lumens
	100L	10000 Lumens	100LHE	10000 Lumens
	140L	14000 Lumens	140LHE	14000 Lumens
	180L	18000 Lumens	180LHE	18000 Lumens
	200L	20000 Lumens	200LHE	20000 Lumens

Lens/Diffuser

ADP	Curved, ribbed
ADSM	Curved, smooth
SDP	Square, ribbed
SDSM	Square, smooth
PDSM	Curved, smooth polycarbonate ‡

Diffusers w/ trim rings

ADPT	Curved, ribbed
ADSMT	Curved, smooth
SDPT	Square, ribbed
SDSMT	Square, smooth
PDSMT	Curved, smooth polycarbonate ‡

Driver

(blank)	MVOLT
120	120V
277	277V
347	347V ‡

Driver

EZ1	eldoLED dims to 1% (0-10v dimming)
GZ1	Generic dims to 1% (0-10v dimming) ‡
GZ10	Generic dims to 10% (0-10v dimming) ‡
SLD	Step-level dimming ‡

Color Temperature

LP830	82CRI, 3000K
LP835	82CRI, 3500K
LP840	82CRI, 4000K
LP850	82CRI, 5000K
LP930	90CRI, 3000K
LP935	90CRI, 3500K
LP940	90CRI, 4000K
LP950	90CRI, 5000K

nLight Interface ‡

nLight Wired

(blank)	no nLight® interface
N80	nLight with 80% lumen management
N80EMG	nLight with 80% lumen management. For use with generator supply EM power ‡
N100	nLight without lumen management
N100EMG	nLight without lumen management. For use with generator supply EM power ‡

nLight Wireless

(blank)	no nLight® interface
NLTAIR2	nLight AIR Generation 2 enabled ‡

Control ‡

nLight Wired

(blank)	no nLight control
NES7	nLight™ nES 7 PIR integral occupancy sensor ‡
NESPDT7	nLight™ nES PDT 7 dual technology integral occupancy control ‡
NES7ADCX	nLight™ nES 7 ADCX PIR integral occupancy sensor with automatic dimming photocell ‡
NESPDT7ADCX	nLight™ nES PDT 7 dual technology integral occupancy sensor with automatic dimming photocell ‡

nLight Wireless

(blank)	no nLight control
RES7	nLight AIR PIR integral occupancy sensor with automatic dimming photocell for Networking Capabilities Individual Control ‡
RES7PDT	nLight AIR PIR integral occupancy sensor with automatic dimming photocell for Zone Control ‡
RIO	nLight AIR radio module without sensor ‡
RES7EM	nLight AIR PIR integral occupancy sensor with automatic dimming photocell and UL924 Emergency Operation, via power interrupt detection ‡
RES7PDTEM	nLight AIR microphonics dual technology occupancy sensor with automatic dimming photocell & UL924 Emergency Operation, via power interrupt detection ‡
RIOEM	nLight AIR radio module less sensor, with UL924 Emergency Operation, via power interrupt detection ‡

Individual Control

MSD7ADCX	PIR integral occupancy sensor with automatic dimming control photocell ‡
MSDPDT7ADCX	PDT integral occupancy sensor with with automatic dimming control photocell ‡
JOT	Wireless room control with "Just One Touch" pairing ‡
JOTVTX15	Wireless occupancy sensor with "Just One Touch" pairing ‡

Standby mode ‡

(blank)	Fixture with embedded sensor turns off when unoccupied
DIM10	Fixture with embedded sensor dims to approximately 10% light output when unoccupied ‡
DIM50	Fixture with embedded sensor dims to approximately 50% light output when unoccupied ‡
NOC	Occupancy sensor disabled ‡

Options

E10WLCP	EM Self-Diagnostic battery pack, 10W Constant Power, Certified in CA Title 20 MAEDBS
EL7L	700 nominal lumens battery pack ‡
EL14L	1400 nominal lumens battery pack ‡
BGTD	Bodine Generator Transfer Device ‡
USPOM	US Point of Manufacture
QMB	Quick Mount Bracket ‡
TRS	Tamper Resistant Screw ‡
GLR	Fast-blowing fuse ‡
GMF	Slow-blowing fuse ‡
FAO	Field Adjustable Output ‡
PLR___	Plug-in wiring, see page 8 for ordering information ‡
PLR1LVG	Plug-in wiring,low voltage dimming ‡
BAA	Buy America(n) Act Compliant

Finish

(blank)	Standard pre-paint white
PAF	Paint After Fabrication White
DNA	Paint After Fabrication Natural Aluminum

NOTE: ‡ indicates option value has ordering restrictions. Please reference the Option Value Ordering Restictions chart on the next page. Options are sorted alphanumerically.

See Stock configurations, Accessories and footnotes on page 4.

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‡ Option Value Ordering Restrictions	
Option value	**Restriction**
347	Not available with E10WLCP, EL7L, EL14L, BGTD or BLWP4 > 85L/ 85LHE.
BLWPCR, BLWPCRDNA, BLWP8CR, BLWP8CRDNA	Cannot be used to continuous row mount 4' fixtures with 8' fixtures.
BGTD	Not available with JOT sensor options or emergency battery options. Must specify voltage. Requires BSE labeling, voltage specific. Consult factory for options. Example: BGTD BSE10.
DIM10, DIM50	Not available with NLTAIR2 or JOT sensor option. Requires occupancy control. Must be ordered with nLight Wired or Individual Control sensor option.
EL7L, EL14L	Only available on BLWP8, 8ft length version of this fixture, in lumen packages 140L or less.
FAO	EZ1 driver required. Not available with USPOM, FAO or lumen packages > 6000LM. FAO is not available with other integrated controls options and restricts the use of external dimming controls. See chart on page 5 for additional details.
GLR, GMF	Must specify voltage. 120 or 277, with GLR and GMF fusing.
GZ1, GZ10	Not available with any Control or Sensor options except JOT & JOTVTX15
JOT, JOTVTX15	Not available with SLD, NLIGHT, NLTAIR2, NOC, USPOM or FAO. Available only on 4' versions with ADPT and ADMST trim options; not available with > 72L or 72LHE lumen packages.
Lumens	Approximate lumen output. For high Efficiency, all versions may not achieve 130+ LPW including 90CRI and versions with integral sensor trim. Refer to photometry on www.acuitybrands.com. See QPL for latest DLC listings.
MSD7ADCX, MSDPDT7ADCX	Must select Lens/Diffuser type with Trim Rings. Not available with nLight interface. 0-10V wires are not accessible via access plate.
N80EMG, N100EMG	Requires a connection to existing nLight network. Power is provided from a separate NLIGHT enabled fixture or external power pack.
NES7, NESPDT7, NES7ADCX, NESPDT7ADCX	Must select Lens/Diffuser type with Trim Rings. Requires N80, N80EMG, N100, or N100EMG. Only available with EZ1 driver.
NLTAIR2	Must select nLight wireless control. Not available with JOT or JOTVTX15
NOC	Not available with JOT sensor options. Can only be ordered in conjunction with EZ1, NLTAIR2, RES7/RES7PDT. Occupancy sensor disabled at factory but can be re-enabled upon commissioning.
PDSM, PDSMT	Not available with HE (high efficiency) performance package on BLWP2 and BLWP4 only.
PLR___, PLR1LVG	Not available with BLWP2. PLR1LVG is not available with Controls options or nLight interface.
QMB	Not available with BLWP2 (2') or BLWP8 (8') fixture.
RES7, RES7PDT, RIO, RES7EM, RES7PDTEM, RIOEM	Must select Lens/Diffuser type with Trim Rings. Requires EZ1 and NLTAIR2 to be specified. Only available with 60L or lower lumen packages on the BLWP4. Only available with 100LHE/80L lumen packages or lower on the BLWP8.
SLD	Not available with any nLight Interface or Control options. Cannot be used with PLR1LVG
TRS	Accessory BLWP TRS T15 BIT available to be ordered with this option. See Accessories section page 3. Order as separate item.

Non-Configurable BLWP:

Stock/MTO	Ci code	Catalog Description	UPC	Lumens	Wattage	LPW	Color Temperature	Voltage	Pallet QTY
MTO	*264V2M	BLWP2 20L ADP LP835	191848282045	1942	17	117	3500 K	120-277	80
	*264V2L	BLWP2 20L ADP LP840	191848282038	1973	17	119	4000 K	120-277	80
	*264CH0	BLWP2 33L ADP LP835	191848080825	3332	30	112	3500 K	120-277	80
	*264CH1	BLWP2 33L ADP LP840	191848080832	3345	30	112	4000 K	120-277	80
	*264CH2	BLWP2 40L ADP LP835	191848080849	3923	37	105	3500 K	120-277	80
	*264CH4	BLWP2 40L ADP LP840	191848080856	4117	37	110	4000 K	120-277	80
STOCK	*264V2K	BLWP4 30L ADP LP835	191848282021	3065	25	123	3500 K	120-277	70
	*264V2H	BLWP4 30L ADP LP840	191848281994	3114	25	125	4000 K	120-277	70
	*264CH5	BLWP4 40L ADP LP835	191848080863	4391	35	127	3500 K	120-277	70
	*264CH6	BLWP4 40L ADP LP840	191848080870	4263	35	123	4000 K	120-277	70
	*264CH7	BLWP4 48L ADP LP835	191848080900	5137	40	129	3500 K	120-277	70
	*264CH8	BLWP4 48L ADP LP840	191848080917	5205	40	131	4000 K	120-277	70

Accessories: *Order as separate catalog number.*

PART number	CI CODE	QTY	Description	Application
BLWP8/4CR	*272PFG	1	CONTINUOUS ROW MOUNT BRACKET FOR ROW CONNECTING BLWP4 and BLWP8 WHT	FOR USE TO MOUNT BLWP8 TO BLWP4, FOR STD FINISH AND PAF
BLWPCR	*250A0S	1	CONTINUOUS ROW MOUNT BRACKET WHT	FOR USE ON BLWP4 ONLY, FOR STD FINISH AND PAF ‡
BLWPCRDNA	*250A1S	1	CONTINUOUS ROW MOUNT BRACKET DNA	FOR USE ON BLWP4 ONLY, FOR DNA FINISH ‡
BLWP8CR	*2543C6	1	CONTINUOUS ROW MOUNT BRACKET WHT	FOR USE ON BLWP8 ONLY, FOR STD FINISH AND PAF ‡
BLWP8CRDNA	*2543CA	1	CONTINUOUS ROW MOUNT BRACKET DNA	FOR USE ON BLWP8 ONLY, FOR DNA FINISH ‡
BLWPCG36 F1	*264R3P	1	BLWPCG36 F1	ADJUSTABLE AIRCRAFT CABLE GRIPPER KIT, 36 INCH F1 CEILING TYPE
BLWPCG36 F2	*264R4G	1	BLWPCG36 F2	CABLE GRIPPER KIT, 36 INCH F2 CEILING TYPE
BLWPCG72 F1	*264R4H	1	BLWPCG72 F1	CABLE GRIPPER KIT, 72 INCH F1 CEILING TYPE
BLWPCG72 F2	*264R4M	1	BLWPCG72 F2	CABLE GRIPPER KIT, 72 INCH F2 CEILING TYPE
BLWPCGF36 F1	*264R4R	1	BLWPCGF36 F1	KIT WITH POWER FEED 36 INCH F1 CEILING TYPE
BLWPCGF36 F2	*264R4U	1	BLWPCGF36 F2	KIT WITH POWER FEED 36 INCH F2 CEILING TYPE
BLWPCGF72 F1	*264R4V	1	BLWPCGF72 F1	KIT WITH POWER FEED 72 INCH F1 CEILING TYPE
BLWPCGF72 F2	*264R4X	1	BLWPCGF72 F2	KIT WITH POWER FEED 72 INCH F2 CEILING TYPE
BLWPCGE36 F1	*264R50	1	BLWPCGE36 F1	KIT WITH EMERGENCY POWER FEED 36 INCH F1 CEILING TYPE
BLWPCGE36 F2	*264R5T	1	BLWPCGE36 F2	KIT WITH EMERGENCY POWER FEED 36 INCH F2 CEILING TYPE
BLWPCGE72 F1	*264R5V	1	BLWPCGE72 F1	KIT WITH EMERGENCY POWER FEED 72 INCH F1 CEILING TYPE
BLWPCGE72 F2	*264R53	1	BLWPCGE72 F2	KIT WITH EMERGENCY POWER FEED 72 INCH F2 CEILING TYPE
BLWPCGFD36 F1	*269V4M	1	BLWPCGFD36 F1	KIT WITH 0-10V DIMMING POWER FEED 36 INCH F1 CEILING TYPE
BLWPCGFD36 F2	*269V5C	1	BLWPCGFD36 F2	KIT WITH 0-10V DIMMING POWER FEED 36 INCH F2 CEILING TYPE
BLWPCGFD72 F1	*269V5N	1	BLWPCGFD72 F1	KIT WITH 0-10V DIMMING POWER FEED 72 INCH F1 CEILING TYPE
BLWPCGFD72 F2	*269V5X	1	BLWPCGFD72 F2	KIT WITH 0-10V DIMMING POWER FEED 72 INCH F2 CEILING TYPE
BLWP TRS T15 BIT	*2516KU	1	BLWP TRS T15 BIT	T15 WITH PIN, TORX BIT FOR TRS OPTION
BLWPQMB	*250A2S	1	BLWP Quick Mount Bracket	QUICK MOUNT BRACKET FOR INSTALLATION TO JUNCTION BOXES WITHOUT HAVING TO REMOVE ANY PARTS IN THE FIXTURE, 4FT FIXTURE ONLY.

nLight® Wired Control Accessories:
Order as separate catalog number. Visit www.acuitybrands.com/products/controls/nlight.

WallPod stations	Model number	Occupancy sensors	Model number
On/Off	nPODM [color]	Small motion 360°, ceiling (PIR / dual tech)	nCM 9 RJB / nCM PDT 9 RJB
On/Off & raise/lower	nPODM DX [color]	Large motion 360°, ceiling (PIR / dual tech)	nCM10 RJB / nCM PDT 10 RJB
Graphic touchscreen	nPOD GFX [color]	Wall switch with raise/lower	nWSX PDT LV DX [color]
Photocell controls	**Model number**	**Cat-5 cable (plenum rated)**	**Model number**
Full range dimming	nCM ADCX RJB	10' cable	CAT5 10FT J1
		30' cable	CAT5 30FT J1

nLight® AIR Control Accessories:
Order as separate catalog number. Visit www.acuitybrands.com/products/controls/nlightair.

Wall switches	Model number
On/Off single pole	rPODB [color] G2
On/Off two pole	rPODB 2P [color] G2
On/Off & raise/lower single pole	rPODB DX [color] G2
On/Off & raise/lower two pole	rPODB 2P DX [color] G2
On/Off & raise/lower single pole	rPODBZ DX WH G2

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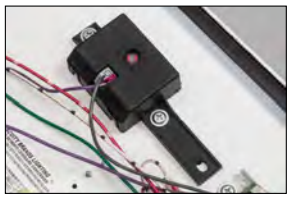
Replacement Parts: *Order as separate catalog number.*

2' Version Replacement Lens		4' Version Replacement Lens		8' Version Replacement Lens	
*264F5E	DBLWP24 ADP	*264F69	DBLWP48 ADP	*2543CE	DBLWP96 ADP
*264F5F	DBLWP24 SDP	*264F6E	DBLWP48 SDP	*2543CG	DBLWP96 SDP
*264F5H	DBLWP24 ADSM	*264F6F	DBLWP48 ADSM	*2543CJ	DBLWP96 ADSM
*264F5J	DBLWP24 SDSM	*264F6G	DBLWP48 SDSM	*2543CM	DBLWP96 SDSM
*264F5L	DBLWP24 ADPT	*264F6H	DBLWP48 ADPT	*2543CN	DBLWP96 ADPT
*264F5P	DBLWP24 SDPT	*264F6K	DBLWP48 SDPT	*2543CP	DBLWP96 SDPT
*264F5U	DBLWP24 ADSMT	*264F6L	DBLWP48 ADSMT	*2543CR	DBLWP96 ADSMT
*264F5W	DBLWP24 SDSMT	*264F6N	DBLWP48 SDSMT	*2543CS	DBLWP96 SDSMT
*264F66	DBLWP24 PDSM	*264F6W	DBLWP48 PDSM	*2543CW	DBLWP96 PDSM
*264F67	DBLWP24 PDSMT	*264F6X	DBLWP48 PDSMT	*2543CX	DBLWP96 PDSMT

FAO SETTINGS (Field Adjustable Output)

	0-10 Voltage Dimmer	% Lumen Output (approximate)	% Wattage (approximate)
Step 8	Full Output	100%	100%
Step 7	9.0 VDC	98%	100%
Step 6	8.0 VDC	88%	86%
Step 5	7.0 VDC	86%	82%
Step 4	6.0 VDC	82%	80%
Step 3	5.0 VDC	76%	75%
Step 2	4.0 VDC	71%	72%
Step 1	3.0 VDC	67%	71%

Simple adjustment of output through the use of a flat head screwdriver.

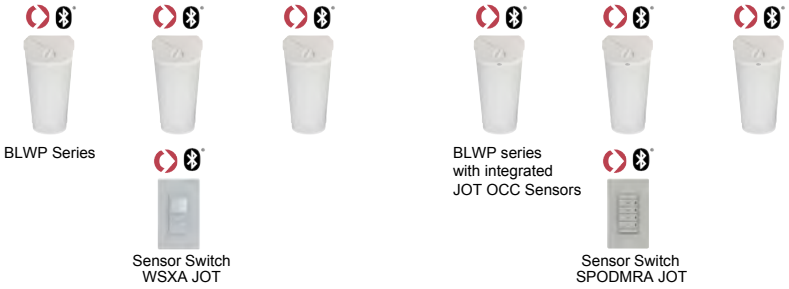


JOT Wireless

JOT
Just One Touch

Sensor Switch JOT Enabled Wireless Solution
Designed with contractors in mind, the Sensor Switch JOT enabled wireless solution offers a straightforward approach to the installation and pairing of lighting fixtures and controls. Absolutely no 0-10V control wires and no mobile apps are needed with JOT enabled products, allowing for lightning speed installation right out of the box.

1. **Power:** Install JOT enabled fixtures and controls as instructed.
2. **Pair:** Insert the pairing tool into the pinhole on the wall switch; press and hold any button for 6 seconds.
3. **Play:** Once paired, each fixture will individually dim down to 10% brightness. All products will be fully functional.



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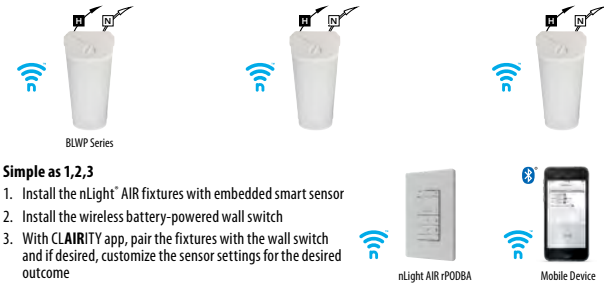
nLight Platform

nLight embedded fixtures offer:	Customers get:
Manual Dimming	Convenience and visual comfort for occupants
Motion Sensing and/or Daylight Harvesting	Energy savings and code compliance
Fixture or Group Level Control	Ability to configure lighting to the space requirements
Flexibility	Ease of fixture moves, adds and changes
Wireless Wall Switch (nLight AIR Only)	Ease and flexibility of placement
Astronomical and Time of Day Scheduling	Energy savings and building security
Scalable Solution	nLight controls to grow with your business
Future-Ready	nLight platform to set foundation for future upgrades and capabilities

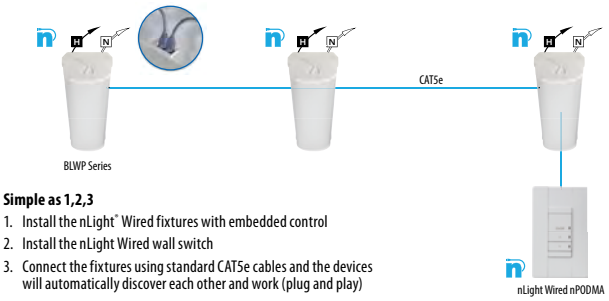
nLight Air Wireless



Simple as 1,2,3

1. Install the nLight® AIR fixtures with embedded smart sensor
2. Install the wireless battery-powered wall switch
3. With CL**AIR**ITY app, pair the fixtures with the wall switch and if desired, customize the sensor settings for the desired outcome

nLight Wired Networking



Simple as 1,2,3

1. Install the nLight® Wired fixtures with embedded control
2. Install the nLight Wired wall switch
3. Connect the fixtures using standard CAT5e cables and the devices will automatically discover each other and work (plug and play)

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Sensor Options					
Option	Automatic Dimming Photocell	Occupancy Sensing		nLight Wired Networking	nLight AIR Networking
		PIR	PDT		
MSD7ADCX	X	X			
MSDPDT7ADCX	X		X		
NES7		X		X	
NES7ADCX	X	X		X	
NESPDT7			X	X	
NESPDT7ADCX	X		X	X	
RES7	X	X			X
RES7PDT	X	X	X		X

Basic nLight Zone

Integrated Sensor with Individual Control

The MSD7ADCX PIR occupancy sensor/automatic dimming photocell is ideal for areas without obstructions and where daylight harvesting may be desired. Suggested applications include, but not limited to, hallways, corridors, storage rooms, and breakrooms or other areas where people are typically moving.

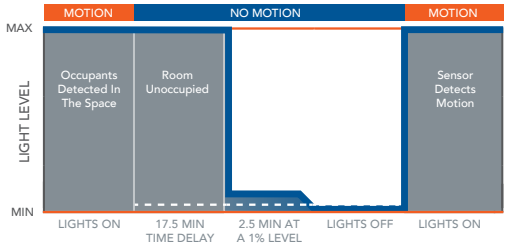
The MSDPDT7ADCX PIR/Microphonics Dual Tech occupancy sensor/automatic dimming photocell is ideal for areas with obstructions and where daylight harvesting is desired. Suggested applications include, but not limited to, open offices, private offices, classrooms, public restrooms, and conference rooms.

nLight Wired Networking

The nES 7 is ideal for small rooms without obstructions or areas with primarily walking motion. Ideal areas include hallways, corridors, storage rooms, and breakrooms. Additionally, the NES7ADCX includes an integrated photocell, which enables daylight harvesting controls.

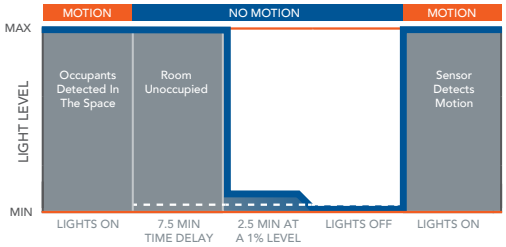
For areas like restrooms, private offices, open offices, conference rooms or any space with obstructions, the nES PDT 7 dual technology sensor is recommended. The nES PDT 7 utilizes both PIR (passive infrared) and Microphonics technologies to detect occupancy. Additionally, the NESPDT7ADCX includes an integrated photocell, which enables daylight harvesting controls which is ideal for areas where windows are present.

Sequence of Operation



*The presetting on the automatic dimming photocell is 5fc.

Sequence of Operation



*The presetting on the automatic dimming photocell is 5fc.

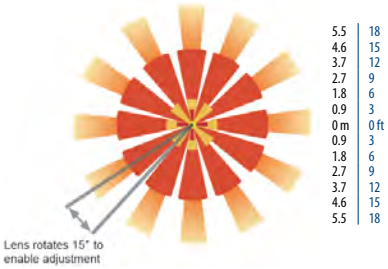
Sensor Coverage Pattern
Mini 360° Lens

- Recommended for walking motion detection from mounting heights between 8 ft (2.44 m) and 20 ft (6.10 m)
- Initial detection of walking motion along sensor axes at distances of 2x the mounting height up to 15 ft (4.57 m) and
- 1.75x up to 20 ft (6.10 m).
- Provides 12 ft (3.66 m) radial detection of small motion when mounted at 9 ft (2.74 m)
- Initial detection will occur earlier when walking across sensor's field of view than when walking directly at sensor

nLight AIR Wireless

nLight AIR is the ideal solution for retrofit or new construction spaces where adding additional wiring can be labor intensive and costly. nLight AIR is available with or without an integral sensor. The integrated rES 7 or rES7 PDT smart sensor is part of each luminaire in the nLight AIR network, which can be grouped to control multiple luminaires. The granularity of control with the digital PIR occupancy detection and daylight sensing makes a great solution for any application.

9 FT Mounting



Simple as 1,2,3

1. Install the nLight® AIR fixtures with embedded smart sensor
2. Install the wireless battery-powered wall switch
3. With CL*AIR*ITY PROapp, pair the fixtures with the wall switch and if desired, customize the sensor settings for the desired outcome

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MOUNTING INFORMATION

For unit or row installation; surface or suspend mounting.

Suspension Methods:

Aircraft Cable Suspension

Order one BLWPCG_, BLWPCGF_, or BLWPCGE_ required for each suspension point.

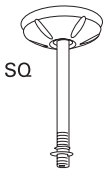
F1 for use with most T-bar and screw slot grid ceiling applications. Designed for on-grid and off-grid installations.

F2 for use with recessed or surface-mount horizontal J-box applications..

See Accessories page on page 3 for part numbers configurations.

Stem Suspension

Individual installation — Two single-stem hangers required.

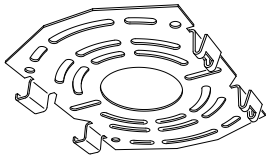


Note: 2' configurations with emergency option cannot be stem mounted.

Accessory Images

(QMB) Quick Mount Bracket

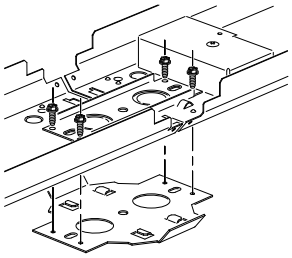
Quick Mount Bracket allows easy installation to junction boxes without having to remove any parts in the fixture.



Note: 2' and 8' configurations not available with QMB accessory.

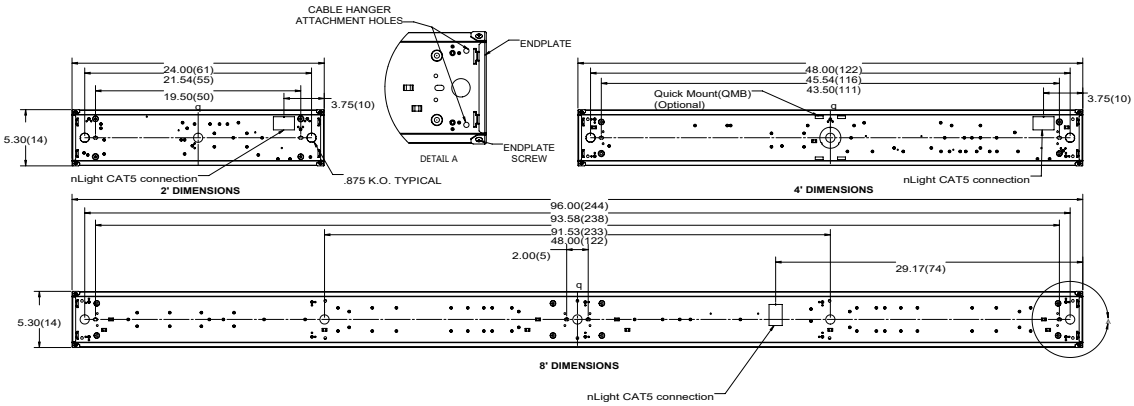
BLWPCR - continuous row mount bracket

Order one (1) BLWPCR bracket per fixture for continuous row applications. Order one hanger(Aircraft Cable Suspension Kit or Stem Suspension Kit) per fixture plus one per joiner required.



DIMENSIONS

All dimensions are inches (centimeters) unless otherwise noted.



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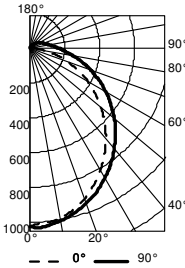
PHOTOMETRICS

BLWP2 33L ADP LP835, 3332 delivered lumens, test no. ISF 37666, tested in accordance to IESNA LM-79.



CP Summary

	0°	90
0°	1024	1024
5°	1009	1027
15°	962	982
25°	867	910
35°	745	809
45°	604	694
55°	456	567
65°	303	436
75°	158	309
85°	36	202
90	0	161

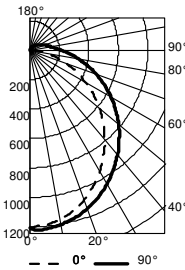
Coefficients of Utilization

pf	80%			20%					
pc				70%			50%		
RCR / pw	70%	50%	30%	50%	30%	10%	50%	30%	10%
0	117	117	117	114	114	114	107	107	107
1	106	100	96	97	93	89	92	88	85
2	96	87	79	84	78	72	79	74	69
3	87	76	67	74	66	59	70	63	57
4	79	67	58	65	57	50	62	54	49
5	73	60	51	58	50	43	55	48	42
6	67	54	45	52	44	38	50	42	37
7	62	49	40	48	39	33	45	38	32
8	58	44	36	43	35	30	41	34	29
9	54	41	32	40	32	27	38	31	26
10	51	38	30	37	29	24	35	28	24

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	790	23.7	23.7
0° - 40°	1286	38.6	38.6
0° - 60°	2278	68.4	68.4
0° - 90°	3096	92.9	92.9
90° - 120°	184	5.5	5.5
90° - 130°	210	6.3	6.3
90° - 150°	233	7.0	7.0
90° - 180°	236	7.1	7.1
0° - 180°	3332	100.0	100.0

BLWP2 40L ADP LP835, 3923 delivered lumens, test no. ISF 37668, tested in accordance to IESNA LM-79.



CP Summary

	0°	90
0°	1210	1210
5°	1190	1219
15°	1130	1178
25°	1019	1100
35°	870	990
45°	706	856
55°	527	711
65°	352	560
75°	179	406
85°	37	268
90	1	214

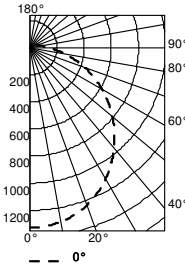
Coefficients of Utilization

pf	80%			20%					
pc				70%			50%		
RCR / pw	70%	50%	30%	50%	30%	10%	50%	30%	10%
0	117	117	117	114	114	114	107	107	107
1	106	100	96	97	93	89	92	88	85
2	96	87	80	84	78	72	80	74	69
3	87	76	67	74	66	60	70	63	58
4	80	67	58	65	57	50	62	55	49
5	73	60	51	58	50	43	55	48	42
6	67	54	45	52	44	38	50	42	37
7	62	49	40	48	39	33	45	38	32
8	58	44	36	43	35	30	41	34	29
9	54	41	32	40	32	27	38	31	26
10	51	38	30	37	29	24	35	28	24

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	932	23.8	23.8
0° - 40°	1519	38.7	38.7
0° - 60°	2687	68.5	68.5
0° - 90°	3646	92.9	92.9
90° - 120°	215	5.5	5.5
90° - 130°	246	6.3	6.3
90° - 150°	273	7.0	7.0
90° - 180°	277	7.1	7.1
0° - 180°	3923	100.0	100.0

BLWP4 40L ADP LP835, 4391 delivered lumens, test no. ISF 37596, tested in accordance to IESNA LM-79.



CP Summary

	0°
0°	1324
5°	1321
15°	1274
25°	1180
35°	1043
45°	881
55°	705
65°	521
75°	343
85°	191
90	138

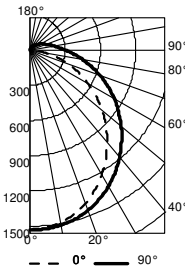
Coefficients of Utilization

pf	80%			20%					
pc				70%			50%		
RCR / pw	70%	50%	30%	50%	30%	10%	50%	30%	10%
0	117	117	117	114	114	114	107	107	107
1	106	100	95	97	93	89	92	88	85
2	96	87	79	84	77	72	79	74	69
3	87	76	67	74	66	59	70	63	57
4	79	67	58	65	57	50	62	54	49
5	73	60	50	58	49	43	55	48	42
6	67	54	44	52	44	37	50	42	36
7	62	48	40	47	39	33	45	38	32
8	58	44	36	43	35	29	41	34	29
9	54	41	32	40	32	26	38	31	26
10	51	37	29	37	29	24	35	28	23

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	1028	23.4	23.4
0° - 40°	1681	38.3	38.3
0° - 60°	2991	68.1	68.1
0° - 90°	4082	93.0	93.0
90° - 120°	249	5.7	5.7
90° - 130°	282	6.4	6.4
90° - 150°	307	7.0	7.0
90° - 180°	309	7.0	7.0
0° - 180°	4391	100.0	100.0

BLWP4 48L ADP LP835, 5137 delivered lumens, test no. ISF 37597, tested in accordance to IESNA LM-79.



CP Summary

	0°	90
0°	1528	1528
5°	1517	1528
15°	1447	1488
25°	1311	1398
35°	1129	1267
45°	913	1102
55°	691	920
65°	460	731
75°	233	540
85°	52	370
90	1	300

Coefficients of Utilization

pf	80%			20%					
pc				70%			50%		
RCR / pw	70%	50%	30%	50%	30%	10%	50%	30%	10%
0	117	117	117	114	114	114	107	107	107
1	105	100	95	97	93	89	91	88	84
2	95	86	79	84	77	71	79	73	69
3	87	75	67	73	65	59	69	62	57
4	79	67	57	65	56	50	61	54	48
5	73	59	50	58	49	43	55	47	41
6	67	53	44	52	43	37	49	42	36
7	62	48	39	47	39	33	45	37	32
8	58	44	35	43	35	29	41	34	28
9	54	40	32	39	32	26	38	31	26
10	51	37	29	36	29	24	35	28	23

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	1188	23.1	23.1
0° - 40°	1944	37.8	37.8
0° - 60°	3464	67.4	67.4
0° - 90°	4754	92.5	92.5
90° - 120°	308	6.0	6.0
90° - 130°	349	6.8	6.8
90° - 150°	381	7.4	7.4
90° - 180°	383	7.5	7.5
0° - 180°	5137	100.0	100.0

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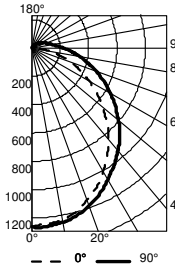
PHOTOMETRICS

BLWP8 40L ADP LP835, 4113 delivered lumens, test no. ISF 37290P226.



CP Summary

	0°	90
0°	1263	1263
5°	1246	1263
15°	1197	1223
25°	1083	1134
35°	928	1011
45°	750	871
55°	558	722
65°	378	564
75°	200	410
85°	57	278
90	9	221

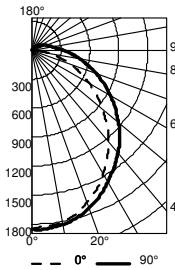
Coefficients of Utilization

pf	80%			20%			50%		
pc	70%	50%	30%	70%	50%	30%	50%	30%	10%
RCR pw									
0	117	117	117	114	114	114	107	107	107
1	106	100	95	97	93	89	92	88	85
2	96	87	79	84	77	72	79	74	69
3	87	76	67	74	66	59	70	63	57
4	79	67	58	65	57	50	62	54	49
5	73	60	51	58	50	43	55	48	42
6	67	54	45	52	44	38	50	42	37
7	62	49	40	48	39	33	45	38	32
8	58	44	36	43	35	30	41	34	29
9	54	41	32	40	32	27	38	31	26
10	51	38	30	37	29	24	35	28	24

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	979	23.8	23.8
0° - 40°	1593	38.7	38.7
0° - 60°	2811	68.4	68.4
0° - 90°	3825	93.0	93.0
90° - 120°	233	5.7	5.7
90° - 130°	263	6.4	6.4
90° - 150°	286	7.0	7.0
90° - 180°	288	7.0	7.0
0° - 180°	4113	100.0	100.0

BLWP8 60L ADP LP835, 6033 delivered lumens, test no. ISF 37290P386.



CP Summary

	0°	90
0°	1853	1853
5°	1827	1853
15°	1756	1794
25°	1588	1664
35°	1361	1483
45°	1101	1277
55°	819	1059
65°	555	828
75°	294	601
85°	84	408
90	13	323

Coefficients of Utilization

pf	80%			20%			50%		
pc	70%	50%	30%	70%	50%	30%	50%	30%	10%
RCR pw									
0	117	117	117	114	114	114	107	107	107
1	106	100	95	97	93	89	92	88	85
2	96	87	79	84	77	72	79	74	69
3	87	76	67	74	66	59	70	63	57
4	79	67	58	65	57	50	62	54	49
5	73	60	51	58	50	43	55	48	42
6	67	54	45	52	44	38	50	42	37
7	62	49	40	48	39	33	45	38	32
8	58	44	36	43	35	30	41	34	29
9	54	41	32	40	32	27	38	31	26
10	51	38	30	37	29	24	35	28	24

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixture
0° - 30°	1437	23.8	23.8
0° - 40°	2336	38.7	38.7
0° - 60°	4124	68.4	68.4
0° - 90°	5611	93.0	93.0
90° - 120°	342	5.7	5.7
90° - 130°	386	6.4	6.4
90° - 150°	420	7.0	7.0
90° - 180°	423	7.0	7.0
0° - 180°	6034	100.0	100.0

PRODUCT INFORMATION

Advanced plug-in system with three-circuit capability. Available on industrial and strip products and a variety of architectural products mounted in continuous rows. 1, 2, 3 and 4-lamp fixtures. PLR22 (2-circuit) and PLR33 (3-circuit) crossover harness switches hot circuit serving next fixture in row. Reduces fixture types on job for alternating circuit applications (see example below.)

Easy one-step installation, saves up to 35% on labor costs. Expanded switching flexibility helps save energy.

Rows can be 50% longer with two-circuit systems. Polarized, lock-together nylon connectors prevent miswiring in the field. #12 THHN conductor, rated 600V, 90°C. White neutral wire included. Grounding accomplished by fixture in-row connectors.

CSA certified systems available with up to 2 circuits. G ground required.

Note: Specifications subject to change without notice.

Wiring

PLR

Advanced 3-Circuit Plug-In

ORDERING INFORMATION Lead times will vary depending on options selected. Consult with your sales representative.

Series	Number of hot wires		Branch circuits				Dimming		Ground	
			Circuits to which ballast is connected		Emergency circuit connected					
PLR	(blank)	Not required for 22 or 33	(blank)	Not required for 22 or 33	(blank)	No emergency circuit	LV	Low-voltage dimming	(blank)	No ground in PLR
PLR22	1	Black	A	Black wire	ELA	Emergency circuit wired to black wire			G	Ground. Maximum 2 circuits
PLR33	2	Black and red	B	Red wire	ELB	Emergency circuit wired to red wire				
	3	Black, red and blue	C	Blue wire	ELC	Emergency circuit wired to blue wire				

Typical Applications

- Multiple-circuit and single-circuit for longer continuous rows
- Multiple-circuit with alternating fixtures on separate circuits, 2-circuit (PLR 22) and 3-circuit (PLR 33)
- Multiple circuit with night-lights located along row as desired

TYPICAL APPLICATIONS										
PLR 3 C	PLR 3 C	PLR 3 C	PLR 3 C	PLR 2 B	PLR 2 B	PLR 2 B	PLR 2 B	PLR 1	PLR 1	PLR 1
(All PLR22)										
Circuit A	Circuit B	Circuit A	Circuit B	Circuit A	Circuit B	Circuit A	Circuit B	Circuit A	Circuit B	Circuit A
(All PLR33)										
Circuit A	Circuit B	Circuit C	Circuit A	Circuit B	Circuit C	Circuit A	Circuit B	Circuit C	Circuit A	Circuit B
PLR 3 A	PLR 3 A	PLR 3 A	PLR 3 C	PLR 3 B	PLR 3 B	PLR 3 B	PLR 3 C	PLR 3 A	PLR 3 A	PLR 3 A

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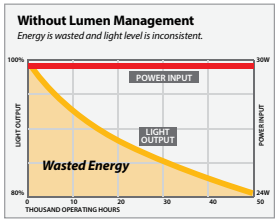
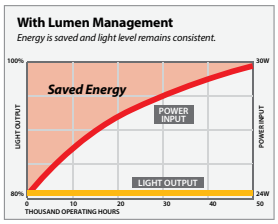
Constant Lumen Management

Enabled by the embedded nLight control, the BLT actively tracks its run-time and manages its light source such that constant lumen output is maintained over the system life. Referred to as lumen management, this feature eliminates the energy waste created by the traditional practice of over-lighting.





How to Estimate Lumens in Emergency Mode
Use the formula below to estimate the delivered lumens in emergency mode
Estimated Lumens = 1.25 x P x LPW
P = Ouput power of emergency driver. P = 10W for E10WLCP option.
LPW = Lumen per watt rating of the luminaire. LPW information available in Performance Data section.

BLWP PERFORMANCE DATA [24]

Lumen Package	Lumens	Input Watts	LPW
BLWP2 8L ADP LP830	825	7	118
BLWP2 8L ADP LP835	855	7	122
BLWP2 8L ADP LP840	868	7	124
BLWP2 8L ADP LP850	893	7	128
BLWP2 20L ADP LP830	1876	17	110
BLWP2 20L ADP LP835	1942	17	114
BLWP2 20L ADP LP840	1973	17	116
BLWP2 20L ADP LP850	2029	17	119
BLWP2 33L ADP LP830	3180	30	107
BLWP2 33L ADP LP835	3332	30	112
BLWP2 33L ADP LP840	3345	30	112
BLWP2 33L ADP LP850	3440	30	115
BLWP2 40L ADP LP830	3914	37	105
BLWP2 40L ADP LP835	3923	37	105
BLWP2 40L ADP LP840	4117	37	110
BLWP2 40L ADP LP850	4234	37	113
BLWP2 48L ADP LP830	4772	44	109
BLWP2 48L ADP LP835	4940	44	112
BLWP2 48L ADP LP840	5019	44	114
BLWP2 48L ADP LP850	5162	44	118
BLWP4 15L ADP LP830	1372	11	126
BLWP4 15L ADP LP835	1420	11	129
BLWP4 15L ADP LP840	1443	11	131
BLWP4 15L ADP LP850	1484	11	135
BLWP4 20L ADP LP830	1985	16	124
BLWP4 20L ADP LP835	2055	16	128
BLWP4 20L ADP LP840	2088	16	131
BLWP4 20L ADP LP850	2147	16	134
BLWP4 30L ADP LP830	2960	25	118
BLWP4 30L ADP LP835	3065	25	123
BLWP4 30L ADP LP840	3114	25	125
BLWP4 30L ADP LP850	3203	25	128
BLWP4 40L ADP LP830	4027	35	115
BLWP4 40L ADP LP835	4391	35	125
BLWP4 40L ADP LP840	4236	35	121
BLWP4 40L ADP LP850	4357	35	124
BLWP4 48L ADP LP830	4948	40	124
BLWP4 48L ADP LP835	5137	40	129
BLWP4 48L ADP LP840	5205	40	131
BLWP4 48L ADP LP850	5353	40	134
BLWP4 60L ADP LP830	6059	49	123
BLWP4 60L ADP LP835	6273	49	127
BLWP4 60L ADP LP840	6373	49	129
BLWP4 60L ADP LP850	6555	49	133
BLWP4 72L ADP LP830	7088	59	121
BLWP4 72L ADP LP835	7338	59	125
BLWP4 72L ADP LP840	7455	59	127
BLWP4 72L ADP LP850	7668	59	131
BLWP4 85L ADP LP830	7972	68	117
BLWP4 85L ADP LP835	8253	68	121
BLWP4 85L ADP LP840	8385	68	123
BLWP4 85L ADP LP850	8624	68	127
BLWP4 100L ADP LP830	9316	85	110
BLWP4 100L ADP LP835	9645	85	114
BLWP4 100L ADP LP840	9799	85	116
BLWP4 100L ADP LP850	10079	85	119

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BLWP PERFORMANCE DATA (continued)

Lumen Package	Lumens	Input Watts	LPW
BLWP2 8LHE ADP LP830	851	8	106
BLWP2 8LHE ADP LP835	881	8	110
BLWP2 8LHE ADP LP840	895	8	112
BLWP2 8LHE ADP LP850	921	8	115
BLWP2 20LHE ADP LP830	1932	16	120
BLWP2 20LHE ADP LP835	2000	16	125
BLWP2 20LHE ADP LP840	2032	16	127
BLWP2 20LHE ADP LP850	2090	16	130
BLWP2 33LHE ADP LP830	3272	26	127
BLWP2 33LHE ADP LP835	3388	26	131
BLWP2 33LHE ADP LP840	3442	26	133
BLWP2 33LHE ADP LP850	3540	26	137
BLWP2 40LHE ADP LP830	3991	32	126
BLWP2 40LHE ADP LP835	4132	32	130
BLWP2 40LHE ADP LP840	4198	32	131
BLWP2 40LHE ADP LP850	4318	32	136
BLWP2 48LHE ADP LP830	4881	39	126
BLWP2 48LHE ADP LP835	5053	39	130
BLWP2 48LHE ADP LP840	5134	39	132
BLWP2 48LHE ADP LP850	5280	39	136
BLWP4 15LHE ADP LP830	1375	11	125
BLWP4 15LHE ADP LP835	1424	11	129
BLWP4 15LHE ADP LP840	1447	11	132
BLWP4 15LHE ADP LP850	1488	11	135
BLWP4 20LHE ADP LP830	1985	16	124
BLWP4 20LHE ADP LP835	2055	16	128
BLWP4 20LHE ADP LP840	2088	16	131
BLWP4 20LHE ADP LP850	2147	16	134
BLWP4 30LHE ADP LP830	3012	24	126
BLWP4 30LHE ADP LP835	3118	24	131
BLWP4 30LHE ADP LP840	3168	24	133
BLWP4 30LHE ADP LP850	3258	24	137
BLWP4 40LHE ADP LP830	4181	33	127
BLWP4 40LHE ADP LP835	4329	33	132
BLWP4 40LHE ADP LP840	4398	33	134
BLWP4 40LHE ADP LP850	4524	33	137
BLWP4 48LHE ADP LP830	5033	39	130
BLWP4 48LHE ADP LP835	5211	39	135
BLWP4 48LHE ADP LP840	5294	39	137
BLWP4 48LHE ADP LP850	5445	39	141
BLWP4 60LHE ADP LP830	6280	47	133
BLWP4 60LHE ADP LP835	6502	47	137
BLWP4 60LHE ADP LP840	6606	47	140
BLWP4 60LHE ADP LP850	6795	47	144
BLWP4 72LHE ADP LP830	7303	56	129
BLWP4 72LHE ADP LP835	7561	56	134
BLWP4 72LHE ADP LP840	7682	56	136
BLWP4 72LHE ADP LP850	7901	56	140
BLWP4 85LHE ADP LP830	8567	69	124
BLWP4 85LHE ADP LP835	8869	69	129
BLWP4 85LHE ADP LP840	9011	69	131
BLWP4 85LHE ADP LP850	9268	69	134
BLWP4 100LHE ADP LP830	9898	80	124
BLWP4 100LHE ADP LP835	10247	80	128
BLWP4 100LHE ADP LP840	10411	80	130
BLWP4 100LHE ADP LP850	10708	80	134

Notes

24 For ADP lens only, for additional lens options refer to photometry on www.acuitybrands.com.

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BLWP8 PERFORMANCE DATA

Lumen Package	Lumens	Input Watts	LPW
BLWP8 40L ADP LP830	3953	30	131
BLWP8 40L ADP LP835	4113	30	136
BLWP8 40L ADP LP840	4107	30	136
BLWP8 40L ADP LP850	4246	30	141
BLWP8 60L ADP LP830	5799	47	122
BLWP8 60L ADP LP835	6034	47	127
BLWP8 60L ADP LP840	6107	47	130
BLWP8 60L ADP LP850	6229	47	132
BLWP8 80L ADP LP830	7643	63	121
BLWP8 80L ADP LP835	7952	63	126
BLWP8 80L ADP LP840	8035	63	127
BLWP8 80L ADP LP850	8210	63	130
BLWP8 100L ADP LP830	9628	82	118
BLWP8 100L ADP LP835	10017	82	123
BLWP8 100L ADP LP840	10133	82	124
BLWP8 100L ADP LP850	10342	82	127
BLWP8 140L ADP LP830	13265	120	111
BLWP8 140L ADP LP835	13802	120	115
BLWP8 140L ADP LP840	13961	120	116
BLWP8 140L ADP LP850	14249	120	119
BLWP8 180L ADP LP830	17781	147	121
BLWP8 180L ADP LP835	18501	147	126
BLWP8 180L ADP LP840	18714	147	127
BLWP8 180L ADP LP850	19101	147	130
BLWP8 200L ADP LP830	18563	156	119
BLWP8 200L ADP LP835	19314	156	124
BLWP8 200L ADP LP840	19537	156	125
BLWP8 200L ADP LP850	19941	156	128

BLWP8 HE PERFORMANCE DATA

Lumen Package	Lumens	Input Watts	LPW
BLWP8 40LHE ADP LP830	3953	30	133
BLWP8 40LHE ADP LP835	4113	30	139
BLWP8 40LHE ADP LP840	4160	30	140
BLWP8 40LHE ADP LP850	4246	30	143
BLWP8 60LHE ADP LP830	5942	46	128
BLWP8 60LHE ADP LP835	6183	46	133
BLWP8 60LHE ADP LP840	6254	46	135
BLWP8 60LHE ADP LP850	6383	46	137
BLWP8 80LHE ADP LP830	7820	59	132
BLWP8 80LHE ADP LP835	8136	59	137
BLWP8 80LHE ADP LP840	8230	59	139
BLWP8 80LHE ADP LP850	8400	59	142
BLWP8 100LHE ADP LP830	9723	74	132
BLWP8 100LHE ADP LP835	10117	74	138
BLWP8 100LHE ADP LP840	10233	74	139
BLWP8 100LHE ADP LP850	10445	74	142
BLWP8 140LHE ADP LP830	13491	104	129
BLWP8 140LHE ADP LP835	14037	104	135
BLWP8 140LHE ADP LP840	14198	104	136
BLWP8 140LHE ADP LP850	14492	104	139
BLWP8 180LHE ADP LP830	17245	130	133
BLWP8 180LHE ADP LP835	17943	130	138
BLWP8 180LHE ADP LP840	18150	130	140
BLWP8 180LHE ADP LP850	18525	130	143
BLWP8 200LHE ADP LP830	19587	144	136
BLWP8 200LHE ADP LP835	20380	144	141
BLWP8 200LHE ADP LP840	20615	144	143
BLWP8 200LHE ADP LP850	21041	144	146

Notes

24 For ADP lens only, for additional lens options refer to photometry on www.acuitybrands.com.

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LYNN 25 BATH

TECH LIGHTING

PRODUCT FEATURES

- Aesthetically appealing due to its modern and simple design style
- Can be mounted horizontally or vertically
- Ideal for vanities and bathrooms
- All lamping options are fully dimmable to create the desired ambiance in any space
- Protected by a 5-year warranty if integrated LED lamp is chosen and 1-year warranty if incandescent lamp option is chosen

LAMPING

Includes 25 watt, 1092.4 delivered lumen, 2700K or 3000K LED module. May be mounted horizontally or vertically. Dimmable with most LED compatible ELV or triac dimmers. 277V compatible with 0-10V dimmers.

Chrome

Antique Bronze Satin Nickel Chrome

ORDERING INFORMATION

700BCLYNN LENGTH (A)	COLOR	FINISH	LAMP	
25 25"	**W** WHITE GLASS	**Z** ANTIQUE BRONZE	**-LED930**	LED 90 CRI 3000K 120V
		C CHROME	**-LED930-277**	LED 90 CRI 3000K 277V
		S SATIN NICKEL		

700BCLYNN _____ _____ _____ _____

JOB NAME _____

NOTES _____

7400 Linder Avenue, Skokie, IL 60077
T 847.410.4400 | F 847.410.4500 | techlighting.com

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Type

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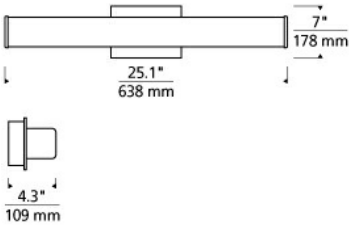
LYNN 25 BATH

TECH LIGHTING

SPECIFICATIONS

HARDWARE MATERIAL	Metal
SHADE MATERIAL	Glass
NET WEIGHT	2.4 lbs
HEIGHT	4.8in
WIDTH	4.3in
LENGTH	25.1in
WET LISTED	
DAMP LISTED	Yes
DRY LISTED	
GENERAL LISTING	ETL Listed
INCLUDES	



LAMPING SPECIFICATIONS

	LED LAMP	INTEGRATED LED	NON LED	NO LAMP
DELIVERED LUMENS		1092.0		
WATTS		25		
MAX WATTAGE PER BULB		25W		
INPUT VOLTAGE		120V 277V		
DIMMING TYPE*		White Glass : ELV, TRIAC White Glass : 0-10V		
CCT		3000K		
CRI		90 CRI		
LED LIFETIME				
L70		>50000		
AVERAGE BULB HOURS				
FIELD SERVICEABLE LED				
LAMP BASE		Integrated LED		
LAMP SHAPE		Integrated LED		
LAMP INCLUDED?		True		
WARRANTY**		5 Years		

* Dimming information available at www.techlighting.com/Downloads#dimming
** Visit techlighting.com for specific warranty limitations and details.

T20 / T24 / JA8 INFORMATION

	Integrated LED	Replacement LED Lamp	No Lamp *
This product can be used to comply with California Building Energy Efficiency Standards 2016 **Title 24** Part 6 / **JA8**.	No		
This product can be used to comply with California Appliance Efficiency Standards 2016 **Title 20** and may be shipped to and sold in California.	N/A		

* If a light fixture or component does not include a lamp or light source, it is the responsibility of the customer to select a lamp that meets the T24 and T20 requirements.

7400 Linder Avenue, Skokie, IL 60077
T 847.410.4400 | F 847.410.4500 | techlighting.com

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ARCHIPELAGO LIGHTING
Lighting | Reinvented

NOSTALGIC

A19

COMMERCIAL GRADE

FILAMENT LED

60 Watt

REPLACEMENT

USES ONLY 7.5W

- NATURAL DIMMING – DIM TO OFF[2]
- SUITABLE FOR WET LOCATIONS
- ENCLOSED RATED
- 25,000 HOURS RATED LIFE
- 3-YEAR LIMITED WARRANTY
- 360° LIGHT DISTRIBUTION
- ENERGY STAR LISTED[3]
- UL LISTED

ALSO AVAILABLE IN:

SILVER-TIP

FROSTED

Ordering Information (A19, 60W)

Model Number	Type	Base	Lumens	Wattage	MOL I MOD	CCT	CRI
LTA19C80024MB	Glass I Clear	E26 I Medium	800LM	7.5W	4.1" I 2.4"	2400K	83
LTA19C80027MB	Glass I Clear	E26 I Medium	800LM	7.5W	4.1" I 2.4"	2700K	83
LTA19C80030MB	Glass I Clear	E26 I Medium	800LM	7.5W	4.1" I 2.4"	3000K	83
LTA19C80041MB	Glass I Clear	E26 I Medium	800LM	7.5W	4.1" I 2.4"	4100K	83
LTA19F80024MB	Glass I Frosted	E26 I Medium	800LM	7.5W	4.1" I 2.4"	2400K	83
LTA19F80027MB	Glass I Frosted	E26 I Medium	800LM	7.5W	4.1" I 2.4"	2700K	83
LTA19F80030MB	Glass I Frosted	E26 I Medium	800LM	7.5W	4.1" I 2.4"	3000K	83
LTA19F80041MB	Glass I Frosted	E26 I Medium	800LM	7.5W	4.1" I 2.4"	4100K	83
LTA19S80024MB	Glass I Silver	E26 I Medium	800LM	7.5W	4.1" I 2.4"	2400K	83
LTA19S80027MB	Glass I Silver	E26 I Medium	800LM	7.5W	4.1" I 2.4"	2700K	83

NOTE 1: Alternative CCTs are available as special order. Please contact sales@archipelagolighting.com for more information.
NOTE 2: Please reference dimmer compatibility list at www.archipelagolighting.com
NOTE 3: Please look for the Energy Star logo for listed products.

RoHS Pb ENERGY STAR PARTNER

ARCHIPELAGO LIGHTING, INC. I 4615 State Street, Montclair CA, 91763 I t: (866) 912-3220 I f: (909 627-2887

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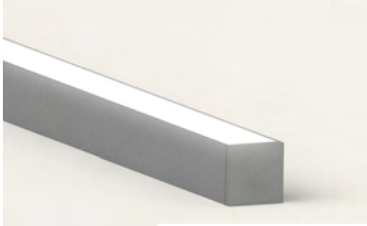
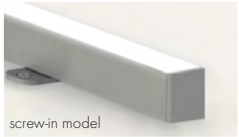


clip-in model



screw-in model

Features

- 24VDC Class 2 for wet locations fixtures made to order up to 144". Fixtures can be linked up to 35' depending on output
- Suitable for undercabinet, millwork recessed and surface mount applications
- Approved for closet/storage space installation per NEC 410.16(A)(3) and 410.16(C)(5)
- Dot free even illumination achievable in HO and VHO with frosted lens
- Vibrant colors with R9 values up to 98
- Proprietary strong bond solder method handles up to 50lbs of torque on wire leads and connectors
- Single micro binned LEDs +/- 30 CCT
- Dims with minimal color shift
- Class 2 listed for wet locations
- 3 Year warranty

MADE IN U.S.A

c UL us LISTED

IC RATED

RoHS

IP68

Single Bin

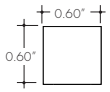
DIM

Finish options

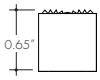
- Silver anodized
- Black powder coated
- Bronze powder coated
- White powder coated

Profile dimensions

fixture/lens profile

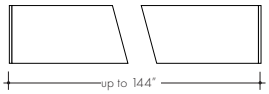


frosted lens

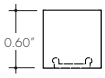


graze lens

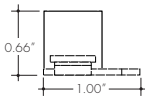
fixture side



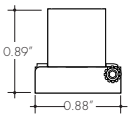
fixture/mounting profile



frosted lens using the clip-in channel



frosted lens using the screw-in bracket



frosted lens using the adjustable bracket

Technical information

OUTPUT OPTIONS

Output	Lumens at 3000K (with frosted lens)	Average power consumption at 4'	Lumens / Watt	Maximum system length Achievable via feed through fixture wiring
SO (LL36)	82 lm/ft	3.2 W/ft	26 lm/W	35'
SOHD (LL72-LO)	74 lm/ft	4.0 W/ft	19 lm/W	24'
HO (LL54)	116 lm/ft	5.2 W/ft	22 lm/W	26'
VHO (LL72)	150 lm/ft	6.5 W/ft	23 lm/W	18'

CCT INFO/LUMEN MULTIPLIER **TM-30-15**

Color temperature	Multiplier (reference - 3000K)	CRI	R_f	R_g
2700K	0.81	97	95	101
3000K	1.00	91	89	98
3500K	1.05	94	90	102
4100K	1.28	94	86	96

Ordering Code

MODEL	LENGTH	CCT	OUTPUT	LENS	MOUNTING	FINISH	POWER FEED POSITION/TYPE	
BOSW	12	27K	SO	F	C	SA	E	1
BOSW - Bosca Wet	12"–144" 4" increments	27K - 2700K 30K - 3000K 35K - 3500K 41K - 4100K	SO - Standard SOHD - Standard High Density HO - High VHO - Very High	F - Frosted G - Grazed	*C - Clip-in SC - Screw-in AH - Adjustable Hinge Mounting	SA - Silver BK - Black BZ - Bronze WH - White (BK, BZ, WH finishes will have an upcharge and require longer lead times)	E - End B - Back S - Side	1 - 72" wire leads 1X2 - 72" wire leads at both ends 2 - 72" wire leads at one end and quick connect at other 3 - Single quick connect 4 - Dual quick connect

***Clip-in mount not recommended for exterior use.**

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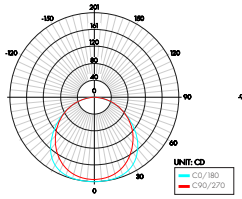
Power consumption per fixture length

Based on operation with PSD series of power supplies.

Photometry

BOSW-48-30K-VHO-F-XX



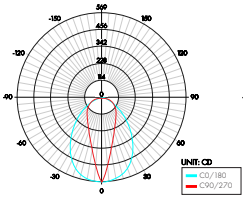
Zonal Lumen Summary 3000K

Zone	Lumen	% Fixture
0-30	158	26%
0-40	262	44%
0-60	468	78%
0-90	591	99%
Total 0-180	598	100%

Beam Angle

109°

BOSW-48-30K-VHO-G-XX



Zonal Lumen Summary 3000K

Zone	Lumen	% Fixture
0-30	281	30%
0-40	425	46%
0-60	676	73%
0-90	879	95%
Total 0-180	926	100%

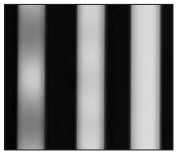
Beam Angle

29°

LED Dotting per output/lens

Output type	Lens Type: Frosted	Lens Type: Graze
SO (LL36)	CD	CD
SOHD (LL72-LO)	ND	CD
HO (LL54)	ND	CD
VHO (LL72)	ND	CD

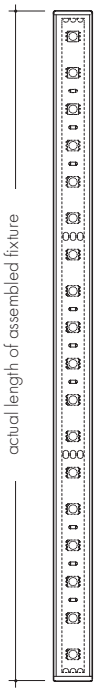
CD = Clear Dotting
SD = Slight Dotting
ND = No Dotting



Clear Dotting | Slight Dotting | NO Dotting

Power consumption per fixture length

Based on operation with PSD series of power supplies.



		SO			SOHD			HO			VHO	
Nominal Length	Actual Length	W/ft	Total wattage	Actual Length	W/ft	Total wattage	Actual Length	W/ft	Total wattage	Actual Length	W/ft	Total wattage
12"	12-13/16"	3.25	3.25	12-12/16"	4.20	4.20	12-12/16"	5.35	5.30	12-12/16"	6.75	6.75
16"	16-11/16"	3.25	4.00	16-10/16"	4.23	5.66	16-11/16"	5.33	7.06	16-10/16"	6.75	9.00
20"	20-11/16"	3.25	5.25	20-10/16"	4.27	7.12	20-11/16"	5.31	8.82	20-10/16"	6.75	11.25
24"	24-9/16"	3.25	6.50	24-9/16"	4.30	8.60	24-10/16"	5.30	10.60	24-9/16"	6.75	13.50
28"	28-8/16"	3.25	7.75	28-8/16"	4.20	9.77	28-8/16"	5.28	12.33	28-8/16"	6.75	16.75
32"	32-8/16"	3.25	8.50	32-7/16"	4.10	10.94	32-8/16"	526	14.06	32-7/16"	6.75	19.00
36"	36-6/16"	3.25	9.75	36-6/16"	4.00	12.10	36-7/16"	5.25	15.80	36-6/16"	6.65	19.95
40"	40-5/16"	3.25	10.25	41-5/16"	4.00	13.43	40-6/16"	5.23	17.40	41-5/16"	6.65	22.20
44"	44-5/16"	3.20	11.75	45-4/16"	4.00	14.76	44-5/16"	5.21	19.00	45-4/16"	6.65	24.40
48"	48-4/16"	3.20	12.80	49-3/16"	4.00	16.10	48-4/16"	5.20	20.60	49-3/16"	6.55	26.20
52"	52-3/16"	3.20	13.30	53-2/16"	3.97	17.27	53-8/16"	5.18	22.40	53-2/16"	6.55	28.50
56"	56-2/16"	3.20	14.80	57-1/16"	3.95	18.44	57-7/16"	5.16	24.20	57-1/16"	6.55	30.50
60"	60-1/16"	3.20	16.00	61 "	3.92	19.60	61-6/16"	5.15	26.00	61 "	6.45	32.25
64"	64 "	3.20	17.00	64-15/16"	3.89	20.73	65-5/16"	5.13	27.60	64-15/16"	6.45	34.40
68"	69-14/16"	3.15	18.00	68-14/16"	3.86	21.86	69-4/16"	5.11	29.20	68-14/16"	6.45	36.55
72"	73-13/16"	3.15	18.90	72-13/16"	3.83	23.00	73-3/16"	5.10	30.80	72-13/16"	6.40	38.40
76"	77-12/16"	3.15	19.00	76-12/16"	3.80	24.06	77-2/16"	5.08	32.40	76-12/16"	6.40	40.50
80"	81-12/16"	3.15	21.50	80-11/16"	3.83	25.12	81-2/16"	5.06	34.00	80-11/16"	6.40	43.00
84"	85-10/16"	3.15	22.05	84-10/16"	3.74	26.20	85-1/16"	5.05	35.70	84-10/16"	6.25	43.75
88"	89-9/16"	3.15	23.00	88-9/16"	3.73	27.33	88-15/16"	5.03	37.10	88-9/16"	6.25	46.00
92"	93-8/16"	3.10	24.00	92-8/16"	3.71	28.46	92-14/16"	5.01	38.50	92-8/16"	6.25	48.00
96"	97-7/16"	3.10	24.80	97-7/16"	3.70	29.60	96-14/16"	5.00	40.00	97-7/16"	6.15	49.20
100"	101-7/16"	3.10	26.30	101-6/16"	3.67	30.56	100-13/16"	4.98	41.60	101-6/16"	6.15	51.25
104"	105-5/16"	3.05	27.10	105-4/16"	3.64	31.53	104-12/16"	4.96	43.20	105-4/16"	6.15	53.00
108"	109-5/16"	3.05	28.00	109-4/16"	3.61	32.50	108-11/16"	4.95	44.80	109-4/16"	6.00	54.00
112"	113-4/16"	3.05	28.50	113-3/16"	3.59	33.46	112-10/16"	4.93	46.20	113-3/16"	6.00	56.00
116"	117-2/16"	3.05	30.00	117-2/16"	3.56	34.43	116-9/16"	4.91	47.60	117-2/16"	6.00	58.00
120"	121-2/16"	3.00	30.50	121-1/16"	3.54	35.40	120-9/16"	4.90	48.90	121-1/16"	5.90	59.00
124"	125-1/16"	3.00	31.50	125 "	3.52	36.36	124-8/16"	4.88	50.40	125 "	5.90	60.60
128"	128-15/16"	3.00	32.50	128-15/16"	3.50	37.33	128-7/16"	4.86	51.90	128-15/16"	5.90	62.20
132"	132-15/16"	2.95	33.50	132-14/16"	3.48	38.30	132-6/16"	4.85	53.30	132-14/16"	5.80	63.80
136"	136-14/16"	2.95	34.30	136-13/16"	3.46	39.20	136-5/16"	4.83	54.70	136-13/16"	5.80	65.30
140"	140-13/16"	2.95	35.20	140-12/16"	3.44	40.10	140-4/16"	4.81	56.10	140-12/16"	5.80	66.80
144"	144-12/16"	2.90	36.00	144-11/16"	3.42	41.00	145-8/16"	4.80	57.40	144-11/16"	5.70	68.40

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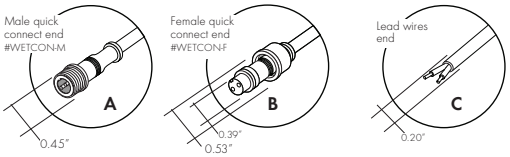
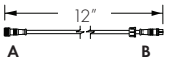
Connectors

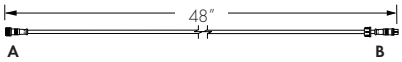


Linking and Extension Cable

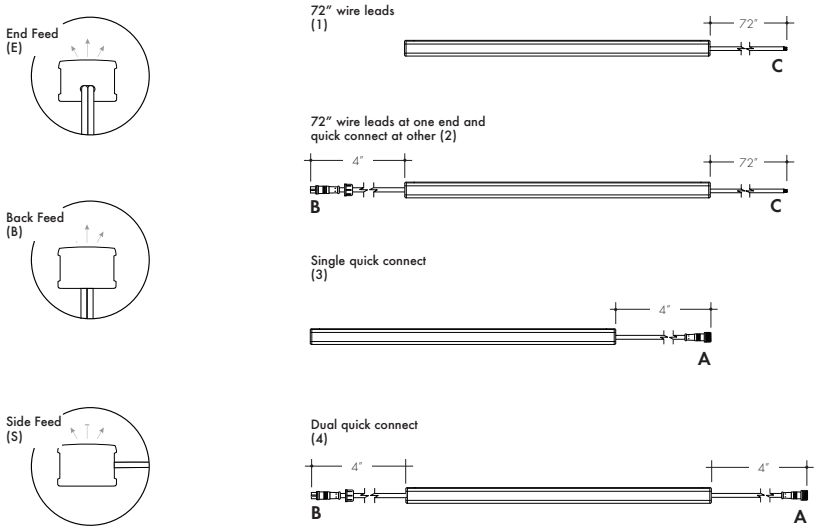
Male/female Joiner 12" - Part # IP67-12



Male/female Joiner 48" - Part # IP67-48



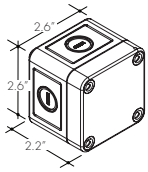
Powerfeed options with fixed bracket



Accessories

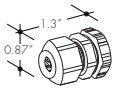
Splice Box:
Wet rated, low voltage splice box, gray

Part # LVSP-WET

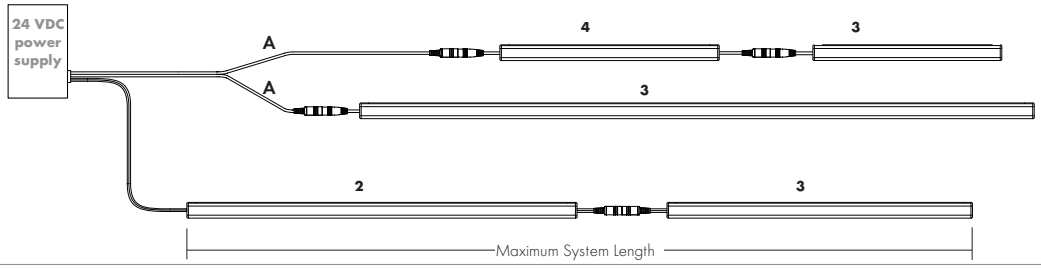


Connector:
Low voltage splice box wet cable management gray

Part # LVSP-WET-CM



Sample layout of powerfeed connections



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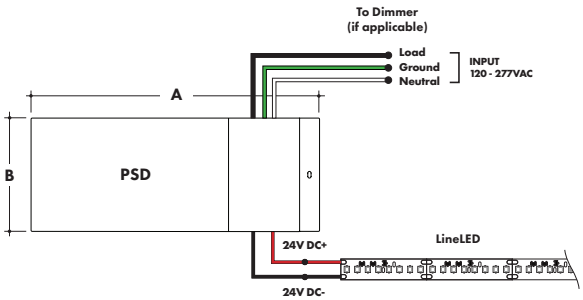
Power Supply

See fixture and power supply instructions & spec sheet for wiring information. Dimming possible in select models - view Luminii website for list of compatible dimmers.

Magnetic Low Voltage Dimming Power Supplies

MODEL		POWER		OUTPUT		INPUT
PSD	-	48	-	24	-	
PSD - PSD Series dims down to 0%		48 - 48 Watt 96 - 96 Watt 288 - 288 Watt (3 x 96Watt)		24 - 24 VDC		Blank - 120 V 240 - 240 V 277 - 277 V

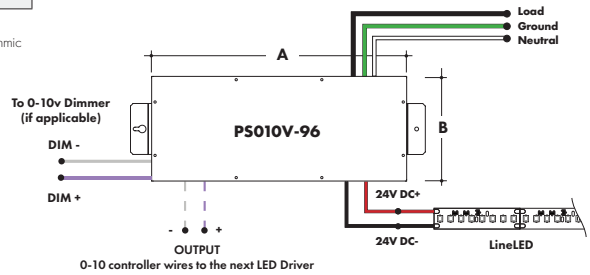
MODELS		PSD 48	PSD 96	PSD 288
A	Length	11.25"	11.25"	13.06"
B	Width	3.42"	3.42"	8.42"
	Depth	3.42"	3.27"	4.47"

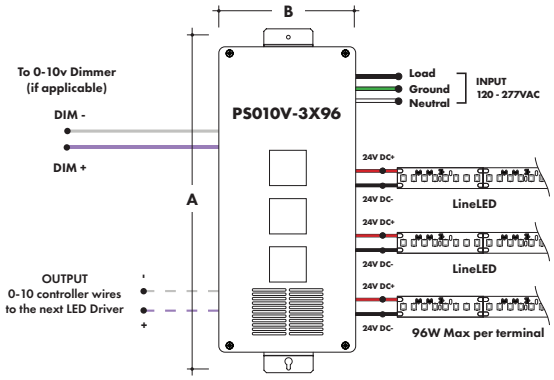


0-10V Dimming Power Supplies

MODEL		POWER		OUTPUT		DIMMING
PS010V	-	96	-	24	-	LIN
PS010V - 0-10V Power Supply dims down to 0%		96 - 96 Watt 3X96 - 3 X 96 Watt		24 - 24 VDC		LIN - Linear LOG - Logarithmic

MODELS		96W	3X96
A	Length	14.40"	15.75"
B	Width	5.20"	6.62"
	Depth	2.60"	4.95"





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Power Supply

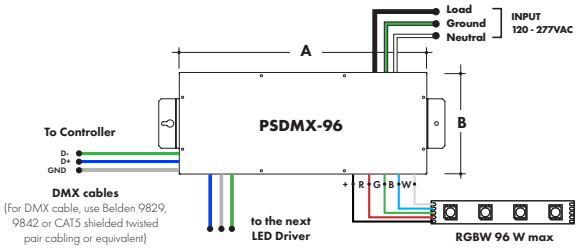
See fixture and power supply instructions & spec sheet for wiring information. Dimming possible in select models - view Luminii website for list of compatible dimmers.

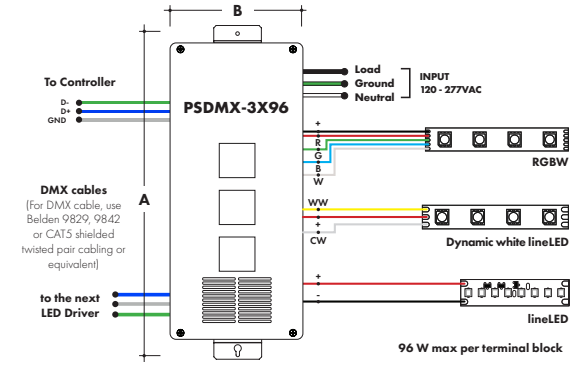
DMX Dimming Power Supplies

MODEL		POWER		OUTPUT
PSDMX	-	96	-	24
PSDMX - DMX Power Supply		96 - 96 Watt 3X96 - 3 X 96 Watt		24 - 24 VDC

Features eldoLED's LINEARdrive configurable dimmable drivers

	MODELS	96W	3X96
A	Length	14.40"	15.75"
B	Width	5.20"	6.62"
	Depth	2.60"	4.95"



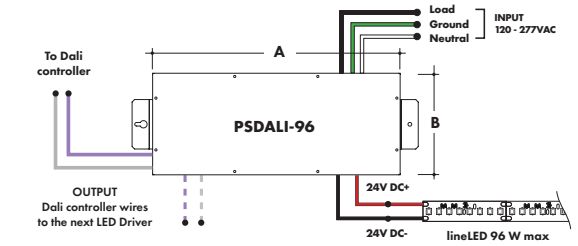


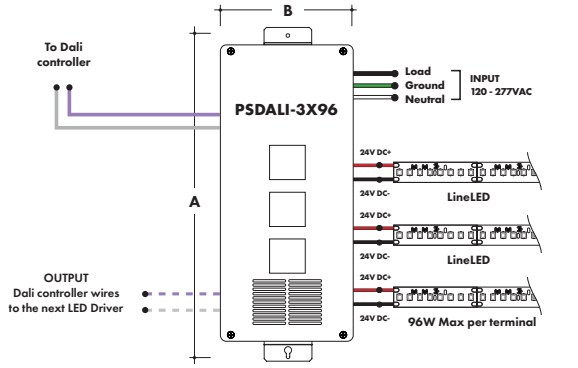
DALI Dimming Power Supplies

MODEL		POWER		OUTPUT
PSDALI	-	96	-	24
PSDALI - DALI Power Supply dims down to 0%		96 - 96 Watt 3X96 - 3 X 96 Watt		24 - 24 VDC

Features eldoLED's LINEARdrive configurable dimmable drivers

	MODELS	96W	3X96
A	Length	14.40"	15.75"
B	Width	5.20"	6.62"
	Depth	2.60"	4.95"





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Power Supply

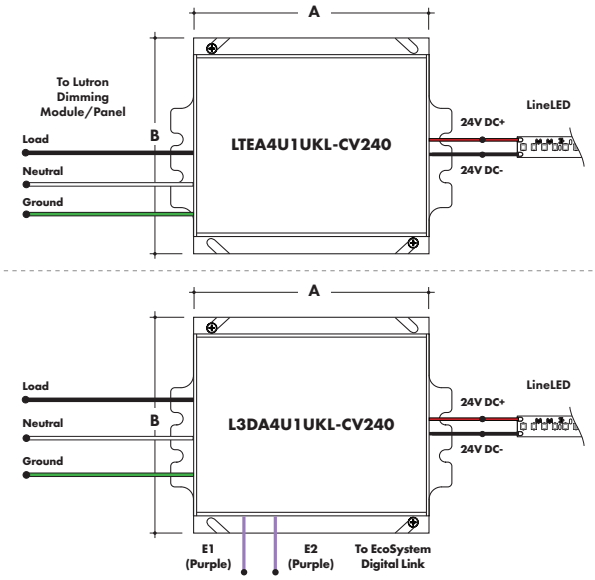
See fixture and power supply instructions & spec sheet for wiring information. Dimming possible in select models - view Luminii website for list of compatible dimmers.

LUTRON®

Luminii is a Lutron OEM Advantage Partner

MODEL	MODEL
LTEA4U1UKL-CV240	L3DA4U1UKL-CV240
Lutron - Hi-lume™ 1% 2-wire LED Driver (120V forward phase only)	Hi-lume™ 1% EcoSystem Voltage LED driver

MODELS	LTEA41UKL-CV240	L3DA4U1UKL-CV240
A Length	4.89"	4.98"
B Width	4.00"	4.00"
Depth	2.62"	2.62"

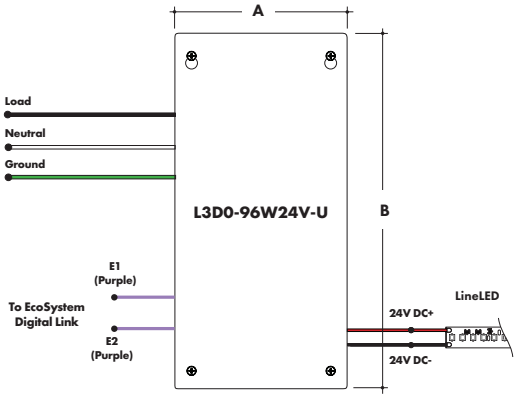


LUTRON®

Luminii is a Lutron OEM Advantage Partner

MODEL
L3D0-96W24V-U
Hi-lume™ 0.1% EcoSystem Voltage LED Driver with Soft-On, Fade-to-Black™

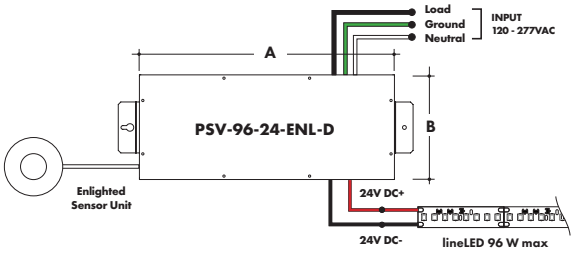
MODELS	L3D0
A Length	10.50"
B Width	5.50"
Depth	2.00"



Enlighted Enabled Dimming Power Supplies:

MODEL	POWER	OUTPUT	DIMMING	LOCATION
PSV	96	24	ENL	D
PSV - PSV Series	96 - 96 Watt	24 - 24 VDC	ENL - Enlighted Dimming	D - Damp

MODELS	96 W
A Length	14.40"
B Width	5.20"
Depth	2.60"



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Type

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Cut sheet 6 of 7

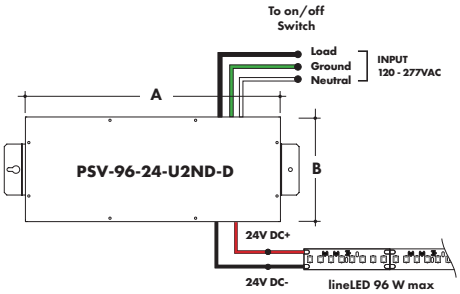
Power Supply

See fixture and power supply instructions & spec sheet for wiring information. Dimming possible in select models - view Luminii website for list of compatible dimmers.

Non-Dimming Power Supply

MODEL	POWER	OUTPUT	DIMMING	LOCATION
PSV	96	24	U2ND	D
PSV - PSV Series	96 - 96 Watt	24 - 24 VDC	U2ND - Non Dimming	D - Damp

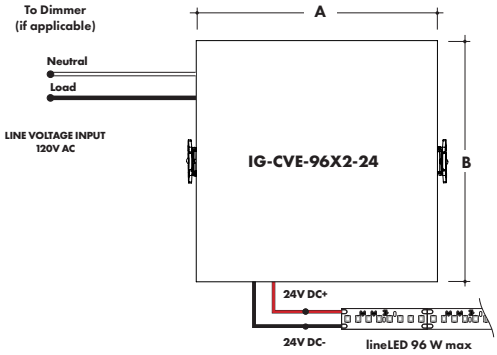
	MODELS	96W
A	Length	14.40"
B	Width	5.20"
	Depth	2.60"



In ground, Electronic Low Voltage Dimming Power Supplies

MODEL		POWER	OUTPUT	INPUT
IG	CVE	96X2	24	
IG - In ground CVE Series	CVE - ELV Dimming DALI - eldoLED Dali dimming Both dims down to 0.1%	96X2 - 2 X 96 Watt	24 - 24 VDC	Blank - 120 V 277 - 240/277 V

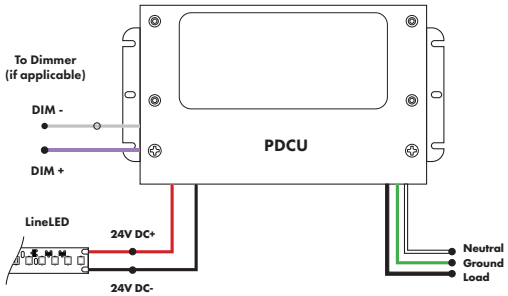
	MODELS	Dual Circuit
A	Length	8.40"
B	Width	8.30"
	Depth	8.10"



Universal Power Supply

MODEL	POWER	OUTPUT
PDCU	30	24
PDCU - PDCU Series PDCUe - PDCUe Series	30 - 30 Watt 60 - 60 Watt 96 - 96 Watt 3X96 - 3x96 Watt	24 - 24 VDC

- 0-10V - 1% dimming
- MLV/ELV/TRIAC - 1% dimming



	MODELS	PDCU 30W	PDCUe 30W	PDCU 60W	PDCUe 60W	PDCU 96W	PDCUe 96W	PDCU 3X96W	PDCUe 3X96W
A	Length	6.50"	6.10"	7.40"	7.93"	8.66"	8.25"	11.85"	9.57"
B	Width	3.73"	3.35"	3.73"	3.35"	3.73"	4.10"	4.32"	5.94"
	Depth	1.61"	1.33"	1.61"	1.32"	1.61"	1.56"	1.81"	1.13"

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Cut sheet 7 of 7

MICRO NITE STAR - SIGN STAR STYLE 'C' LED

IP66 RATED

DATE:	PROJECT:	TYPE:

CATALOG NUMBER LOGIC:

**36" maximum stem length with Power Canopy option.*

***Designed for use with 12 VAC. LED transformer. Requires magnetic low voltage dimmer.*

CATALOG NUMBER LOGIC		
Example: SN - 33 - C - MN - LED - e67 - SP - WHW - 12 - 11 - A - PC-TRe20		
MATERIAL		
Aluminum		
SERIES		
SN - Sign Star		
STEM LENGTH		
18" (Standard), 24", 30", 36", *42", or *48"		
STYLE		
C - Straight Mount		
FIXTURE		
MN - Micro Nite Star		
SOURCE		
LED - with Integral Dimming Driver**		
LED TYPE		
e67 - 7W LED/2700K	e69 - 7W LED/4000K	
e68 - 7W LED/3000K	e75 - 7W LED/Amber	
OPTICS		
SP - Spot (17°)	MFL - Medium Flood (25°)	FL - Flood (30°)
FINISH		
Standard Finishes (BZP, BZW, BLP, BLW, WHP, WHW, SAP, VER)		
Premium Finish (ABP, AMG, AQW, BCM, BGE, BPP, CAP, CMG, CRI, CRM, HUG, MDS, NBP, OCP, RMG, SDS, SMG, TXF, WCP, WIR)		
(Also available in RAL Finishes. See submittal SUB-1439-00)		
LENS TYPE		
12 - Soft Focus	13 - Rectilinear	
SHIELDING		
11 - Honeycomb Baffle		
CAP STYLE		
A - 45°		
B - 90°		
C - Flush		
D - 45° Less Weephole (Interior use only)		
E - 90° Less Weephole (Interior use only)		
OPTIONS		
PC-TRe20 - Power Canopy with TRe20 Electronic Transformer (105-300 VAC. 50/60 Hz. non-dimming)*		
UPM - Universal Power Module		

B-K LIGHTING | **MADE IN THE USA** | **559.438.5800 | INFO@BKLIGHTING.COM | BKLIGHTING.COM**

04/14/2020 SKU-1057
SUB-2199-00

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W7

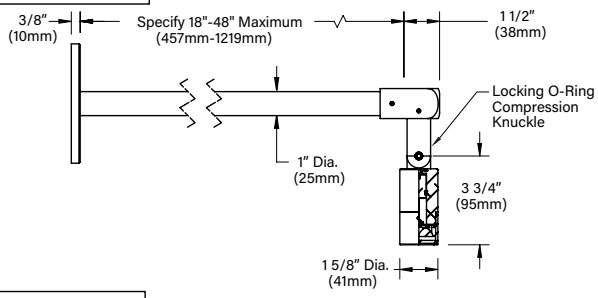
Cut sheet 1 of 4

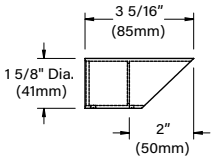
MICRO NITE STAR - SIGN STAR STYLE 'C' LED

IP66 RATED

DATE:	PROJECT:	TYPE:

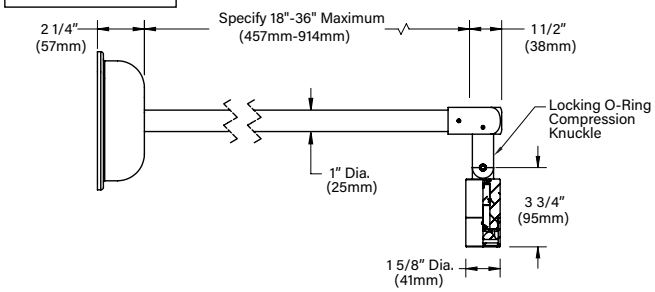
CANOPY - SIDE VIEW

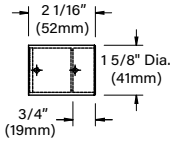




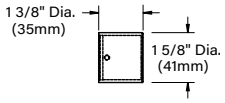
"A/D" CAP

PC - SIDE VIEW



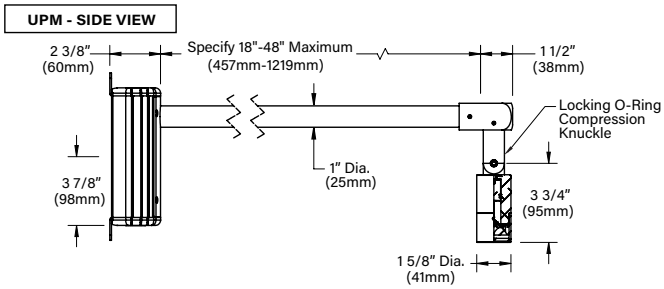


"B/E" CAP



"C" CAP

UPM - SIDE VIEW



STANDARD FINISHES

Satin Black (BLP)	Satin Bronze (BZP)	Satin White (WHP)	Satin Aluminum (SAP)
Black Wrinkle (BLW)	Bronze Wrinkle (BZW)	White Wrinkle (WHW)	Verde (VER)

Click Here to view larger, full-color swatches of all available finishes on our website.

PREMIUM FINISHES

Cascade Mtn. Granite (CMG)	Rocky Mtn. Granite (RMG)	Sierra Mtn Granite (SMG)	Aleutian Mtn Granite (AMG)	Textured Forest (TXF)
Black Chrome (BCM)	Beige (BGE)	Weathered Copper (WCP)	Old Copper (OCP)	Hunter Green (HUG)
Cracked Ice (CRI)	Mojave Desert Sandstone (MDS)	Antique Brass Powder (ABP)	Brown Patina Powder (BPP)	Sonoran Desert Sandstone (SDS)
Weathered Iron (WIR)	Clear Anodized Powder (CAP)	Cream (CRM)	Antique White (AQW)	Natural Brass Powder (NBP)

B-K LIGHTING | **MADE IN THE USA** | **559.438.5800 | INFO@BKLIGHTING.COM | BKLIGHTING.COM**

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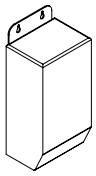
MICRO NITE STAR - SIGN STAR STYLE 'C' LED

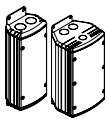
IP66 RATED

DATE:	PROJECT:	TYPE:

Accessories (Configure separately)



TR Series



UPMRM

SPECIFICATIONS

ELECTRICAL	WATTAGE	7W LED
	WIRING	PVC coated, 18AWG, 150V, 60°C rated and certified to UL 1838 standard.
	REMOTE TRANSFORMER	For use with 12VAC remote transformer or magnetic transformers only. B-K Lighting cannot guarantee performance with third party manufacturers' transformers.
PHYSICAL	MATERIALS	Furnished in copper-free aluminum (6061-T6).
	STYLE	C style features straight profile with machined adapter for 90° transition from fixture to stem.
	BODY	Unibody design is fully machined from solid billet and provides enclosed, water-proof wireway and integral heat sink for maximum component life. Integral knuckle for maximum mechanical strength. High temperature, silicone 'O' Ring provides water-tight seal.
	KNUCKLE	LOCK Knuckle is integral to the body and features an interior taper machined from solid billet and a second, reverse angle taper allowing full 180° vertical adjustment without the use of aim-limiting serrated teeth. High temperature, silicone 'O' Ring provides water-tight seal and compressive resistance to maintain fixture position. Design withstands 73 lbs. static load prior to movement for optical alignment with a ½" pipe thread for mounting.
	CAP	Fully machined and accommodates one (1) lens or louver media.
	STEM	Fully machined, 1" dia. with internal threads for maximum visual appeal. Available in configurable lengths to 48" maximum.
	LENS	Shock-resistant, tempered glass lens is factory adhered to fixture cap and provides hermetically sealed optical compartment.
	LED	Integrated solid state system. High power, forward throw source complies with ANSI C78.377 binning requirements. Exceeds ENERGY STAR® lumen maintenance requirements. LM-80 certified components. Integral non-dimming driver. Minimum 50,000 hour rated life at 70% of initial lumens (L70). LED technology provides long life, significant energy reduction and exceptional thermal management.
	DIMMING	Line voltage dimmable via magnetic low voltage dimmer with dedicated neutral conductor. For purposes of dimming: Remote magnetic transformer with LED loads should be loaded to 25% of the transformer VA (watts) rated value.
	OPTICS	Interchangeable, color-coded OPTIKIT modules permit field changes to optical distribution.
	INSTALLATION	5" dia., machined canopy permits mounting to 4" octagonal junction box. Junction box installation must be designed to hold full fulcrum weight of fixture (junction box and gasket by others).
	HARDWARE	Tamper-resistant, stainless steel hardware. LOCK aiming screw and canopy mounting screws are black oxide treated for additional corrosion resistance.
	FINISH	StarGuard, our 15-stage chromate-free process cleans and conversion coats aluminum components prior to application of Class 'A' TGIC polyester powder coating and is RoHS compliant. Powder coat or metal finish options available for brass material and metal finish option only for stainless steel material.
	WARRANTY	5-year limited warranty.
	CERTIFICATION & LISTING	UL tested to IESNA LM-79. UL listed. Certified to CAN/CSA/ANSI standards. RoHS compliant. Suitable for indoor or outdoor use, in wet locations, and for installation within 4' of the ground. IP66 Rated. Made in the USA with sustainable materials.

c UL us LISTED

RoHS

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LAMP & DRIVER DATA (e67, e68, e69, e75)

DATE:	PROJECT:	TYPE:

CATALOG NUMBER LOGIC:

DRIVER DATA	Input Volts	InRush Current	Operating	Dimmable	Operation Ambient Temperature
	12VAC/DC 50/60Hz	<250mA (non-dimmed)	500mA	Magnetic Low Voltage Dimmer	-22°F-194°F (-30°C - 90°C)

LM79 DATA				L70 DATA	OPTICAL DATA		
BK No.	CCT (Typ.)	CRI (Typ.)	Input Watts (Typ.)	Minimum Rated Life (hrs.) 70% of initial lumens (L_{70})	Angle	CBCP	Delivered Lumens
e67	2700K	80	7	50,000	17°	3632	459
	2700K	80	7	50,000	25°	1708	435
	2700K	80	7	50,000	30°	1337	438
e68	3000K	80	7	50,000	17°	3871	489
	3000K	80	7	50,000	25°	1821	464
	3000K	80	7	50,000	30°	1425	467
e69	4000K	80	7	50,000	17°	3991	504
	4000K	80	7	50,000	25°	1877	478
	4000K	80	7	50,000	30°	1469	481
e75	Amber (590nm)	~	7	50,000	~	~	~

OPTICS

Optic	Angle
SP - Spot	17°
MFL - Medium Flood	25°
FL - Flood	30°

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SURFACE CONTROLTrack • SPECIFICATIONS

GENERAL CONTROLTrack shall allow fixtures to be located anywhere along the track length. Fixtures shall be easily focused, switched, dimmed, accessorized and removed as desired. Track system shall have a twelve year warranty from date of shipment.

MECHANICAL CONTROLTrack shall be constructed of .070 (2mm) extruded aluminum with overall height of 1.42 (36mm) and overall width of 1.812 (46mm).

CONTROLTrack shall be available in nominal 4 foot (1.2m), 8 foot (2.4m), and 12 foot (3.7m) lengths, in Silver, Black, and White high temperature baked paint finish. Track shall be field cuttable to any length with a single flush cut.

CONTROLTrack system shall be available with End Feed, End Cap, Straight Mini-Joiner, Straight Joiner/Feeder, L Joiner/Feeder, T Joiner/Feeder, and X Joiner/Feeder as standard components.

Track shall have the ability to be directly surface mounted. Track shall have pre-punched mounting slots for direct mounting to any surface. Track shall have the ability to: be mounted 1/2 inch (13mm) from a surface by extruded aluminum mounting clips, be suspended from a surface by a field cuttable stainless steel cable system, be suspended from a surface by a field cuttable steel stem system, and be mounted into UniTrack/Gemini housing.

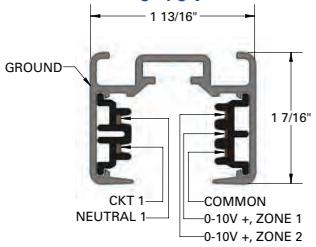
ELECTRICAL CONTROLTrack and components shall be ETL listed, CE Certified, and comply with the National Electric Code standards for Lighting Track. One circuit CONTROLTrack shall be rated for 120/250V or 277V at 50/60 Hz. 20 amp maximum each circuit. Each circuit shall be comprised of flat copper busbars and have a separate neutral busbar for each circuit. **Track shall have integral wiring channels for four (4) additional #12 THHN wire. This shall allow the creation of two (2) additional 20 amp circuits, which can be dropped into any Joiner/Feeder, for a total track power capacity of 60 amps.** All busbars shall be insulated to prevent contact with aluminum extrusion.

Track shall have electric feed capability through all Joiner/Feeders (except Mini-Joiner) using either ½" or ¾" U.S. trade size knock-outs (.875 diameter [22mm] or 1.125 diameter [29mm]). All Joiner/Feeder circuits can be easily field modified by changing connector locations. All Joiner/Feeders shall be available in Black, White, and Silver GE fiber reinforced Lexan.

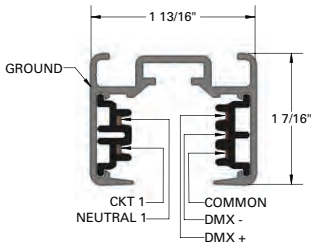
CONTROLTrack shall have one set of AC busbars equivalent to 12 AWG wire and an additional 3 flat copper busbars equivalent to 14 AWG wire, for use with low voltage data communication to control fixtures connected to track. Protocols include up to two zones of 0-10V control, DMX and Lutron EcoSystem.

FIXTURE FITTING INTERFACE Track shall accept GE fiber reinforced Lexan™ fixture fittings which positively lock into track and cannot be energized by the integral switch until safety interlock handle is in the closed position. Safety interlock shall also prevent fixture fitting removal from track unless the switch is in the "off" position. Upon insertion of fixture fitting into track, grounding connection from fixture fitting to track shall be automatically completed before any electrical contact is made with busbars. When removing fixture fitting from track, the grounding connection shall automatically be disconnected last. The fixture fitting shall recess into the track, creating a minimal profile below the track. Fixture fitting shall not allow connection of data circuit to high voltage supply.

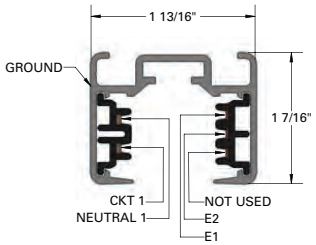
One Ckt 120/250V CONTROLTrack
0-10V



One Ckt 120/250V CONTROLTrack
DMX



One Ckt 120/250V CONTROLTrack
LUTRON ECOSYSTEM



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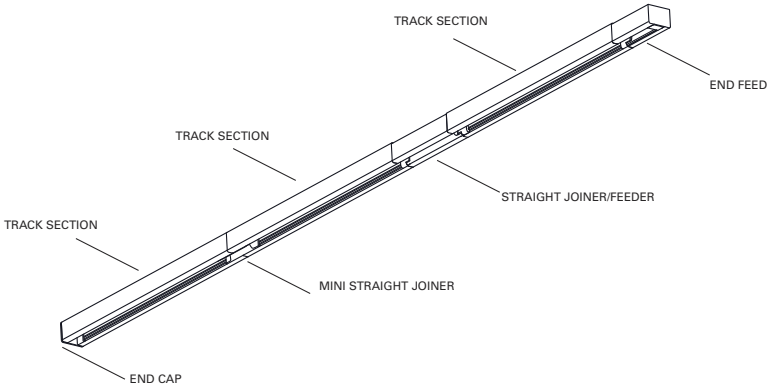
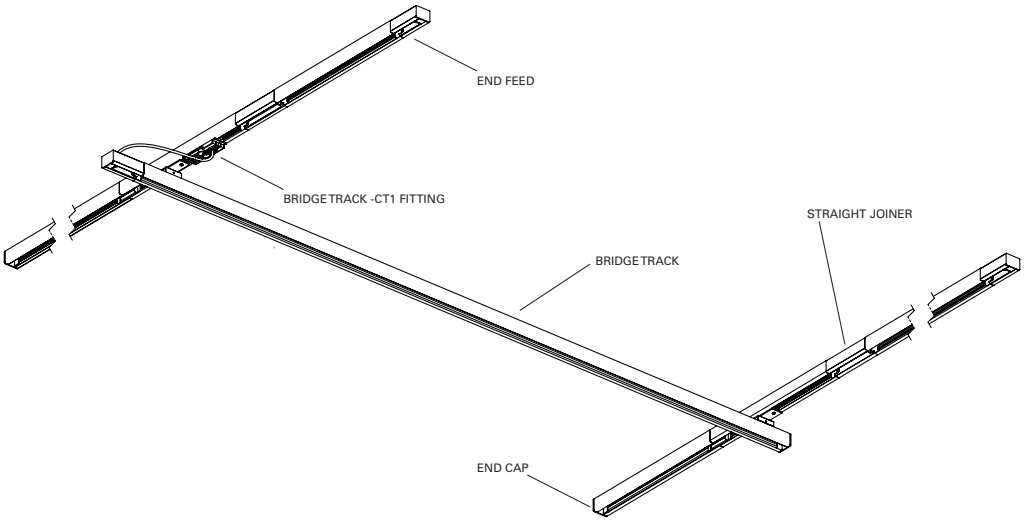
SURFACE CONTROLTrack • CONFIGURATIONS

Straight Run Application



Bridge Track Application



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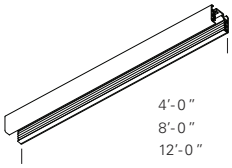
SURFACE CONTROLTrack • COMPONENTS

Key Features / Applications

ETL listed, Dry Location • IBEW union made at LSI plant in USA • Specification grade heavy duty .070 (2mm) extruded aluminum track • 4 foot (1.2m), 8 foot (2.4m) and 12 foot (3.7m) field cuttable lengths • One circuit 20 amp capacity/120/250 volt • 100 amp total capacity when using integral wireways • Copper busbars equivalent to #12 AWG wire used as circuit • Separate neutral track conductor used for each circuit • Black, White, and Silver finishes • All Joiner/Feeders, Mini-Joiners, End Feeds and End Caps are injection molded of GE fiber reinforced Lexan™ • All Joiner/Feeders are easily wired via plug-in connector system • All Joiner/Feeder circuits can be easily field modified by changing connector locations • Fixture fitting recesses into track for minimum profile • LSI surface CONTROLTrack can be mounted directly to any surface at least 5'-0" above finished floor.

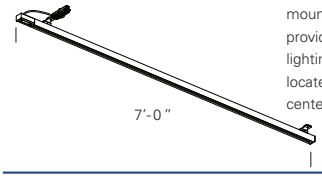
Surface Track Sections



Surface Track Sections are used in conjunction with an end feed, end cap and a variety of Joiner/Feeders to form track runs and configurations. Track section lengths are actual 4 foot (1.2m), 8 foot (2.4m), and 12 foot (3.7m) which are field cuttable.

	Part Number	
One Circuit Control	**TRK-SC-XX1-YYYZ**	
XX=Length	YYY=Voltage	Z=Paint Color
☐ **04**=4ft Track	☐ **120**=120V	☐ **B**=Black
☐ **08**=8ft Track	☐ **230**=220V-240V	☐ **W**=White
☐ **12**=12ft Track	☐ **277**=277V	☐ **S**=Silver

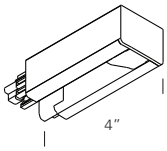
Bridge Track



Bridge Track (7 feet) is a complete, portable, field cuttable, surface track system that mechanically and electrically mounts to and spans parallel runs of LSI track. Bridge Track provides an additional range of striking angles for track lighting fixtures or for centering a fixture over a target located between parallel runs of track up to 6 foot (1.8m) on center. Consult factory for DMX options.

	Part Number	
One Circuit Control	**TRK-SC-BT1-YYYZ**	
	YYY=Voltage	Z=Paint Color
	☐ **120**=120V	☐ **B**=Black
	☐ **230**=220V-240V	☐ **W**=White
	☐ **277**=277V	☐ **S**=Silver

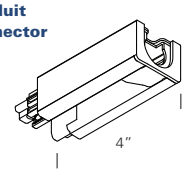
End Feed



End Feed is used in conjunction with a Canopy Kit for top feeding from a recessed outlet box and can also be top fed directly with cable.

	Part Number	
One Circuit Control, Left	**TRK-SC-EF1L-YYYZ**	
One Circuit Control, Right	**TRK-SC-EF1R-YYYZ**	
	YYY=Voltage	Z=Paint Color
	☐ **120**=120V	☐ **B**=Black
	☐ **230**=220V-240V	☐ **W**=White
	☐ **277**=277V	☐ **S**=Silver

End Feed for Conduit Connector



End Feed for Conduit Connector is used when feeding directly into the end of an End Feed. Connector supplied with 1/2" US trade size hole (.875 diameter [22mm]).

	Part Number	
One Circuit Control, Left	**TRK-SC-EFC1L-YYYZ**	
One Circuit Control, Right	**TRK-SC-EFC1R-YYYZ**	
	YYY=Voltage	Z=Paint Color
	☐ **120**=120V	☐ **B**=Black
	☐ **230**=220V-240V	☐ **W**=White
	☐ **277**=277V	☐ **S**=Silver

* Due to the possibilities of electronic interference, it is recommended to feed power and data lines from opposite ends of a track run. Data and power may be fed from one end provided that proper armored/shielded cable is used. Install per NEC and local codes.

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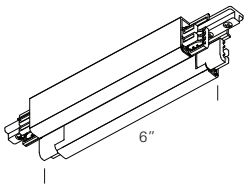
SURFACE CONTROLTrack • COMPONENTS

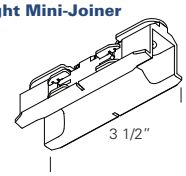
Straight Joiner/Feeder



Straight Joiner/Feeder is used to mechanically and electrically couple any two lengths of track in a straight line. Straight Joiner/Feeder can also be top fed to energize the track from a recessed junction box when used in conjunction with appropriate Canopy Kit or can be top fed directly with cable or conduit. CONTROLTrack feeds may be used for either power or control.*

	Part Number	
One Circuit Control	TRK- SC-SJ1-YYYZ	
	YYY=Voltage	Z=Paint Color
	☐ **120**=120V	☐ **B**=Black
	☐ **230**=220V-240V	☐ **W**=White
	☐ **277**=277V	☐ **S**=Silver

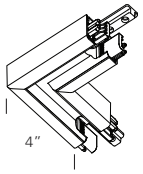
Straight Mini-Joiner



Straight Mini-Joiner is used to mechanically and electrically couple any two lengths of track in a straight line. Not for use as feeder.

	Part Number
One Circuit Control	TRK- SC-MJ1-YYY
YYY=Voltage	
☐ **120**=120V	
☐ **230**=220V-240V	
☐ **277**=277V	

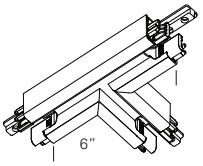
L Joiner/Feeder



L Joiner/Feeder is used to mechanically and electrically couple any two lengths of track in an L right angle configuration. This L Joiner/Feeder can also be top fed directly from electrical cable to energize the track. Internal joiner wiring can be modified in the field.

	Part Number	
One Circuit Control	TRK- SC-LJ1-YYYZ	
	YYY=Voltage	Z=Paint Color
	☐ **120**=120V	☐ **B**=Black
	☐ **230**=220V-240V	☐ **W**=White
	☐ **277**=277V	☐ **S**=Silver

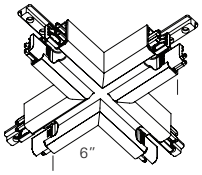
T Joiner/Feeder



T Joiner/Feeder is used to mechanically and electrically couple any three lengths of track in a T configuration. This T Joiner/Feeder can also be top fed directly from electrical cable to energize the track. Internal Joiner wiring can be field modified. Note: A right or a left T must be ordered and must be used directly opposite each other when used in a configuration so that busbar continuity is maintained.

	Part Number	
One Circuit Control, Left	TRK- SC-TJ1L- YYYZ	
One Circuit Control, Right	TRK- SC-TJ1R-YYYZ	
	YYY=Voltage	Z=Paint Color
	☐ **120**=120V	☐ **B**=Black
	☐ **230**=220V-240V	☐ **W**=White
	☐ **277**=277V	☐ **S**=Silver

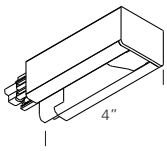
X Joiner/Feeder



X Joiner/Feeder is used to mechanically and electrically couple any four lengths of track in an X configuration. This X Joiner/Feeder can also be top fed directly from electrical cable to energize the track. Internal joiner wiring can be modified in the field.

	Part Number	
One Circuit Control	TRK- SC-XJ1-YYYZ	
	YYY=Voltage	Z=Paint Color
	☐ **120**=120V	☐ **B**=Black
	☐ **230**=220V-240V	☐ **W**=White
	☐ **277**=277V	☐ **S**=Silver

End Feed Terminator



Terminates the end of a DMX run with a 120 ohm resistor. Installed on the end of the track. See DMX guidelines for more info. Power can be fed into this feed.

	Part Number	
One Circuit Control, Left	TRK- SC-EFT1L-YYYZ	
One Circuit Control, Right	TRK- SC-EFT1R-YYYZ	
	YYY=Voltage	Z=Paint Color
	☐ **120**=120V	☐ **B**=Black
	☐ **230**=220V-240V	☐ **W**=White
	☐ **277**=277V	☐ **S**=Silver

* Due to the possibilities of electronic interference, it is recommended to feed power and data lines from opposite ends of a track run. Data and power may be fed from one end provided that proper armored/shielded cable is used. Install per NEC and local codes.

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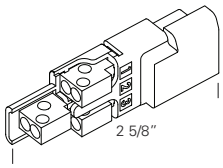
SURFACE CONTROLTrack • COMPONENTS

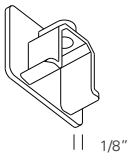
Connector DMX Terminator



Terminates the end of a DMX run with a 120 ohm resistor. Installed in a feed section. See DMX guidelines for more information. Not to be used with portable DMX terminator.

	Part Number
One Circuit Control, Left	**TRK-AC-CT1L**
One Circuit Control, Right	**TRK-AC-CT1R**

End Cap

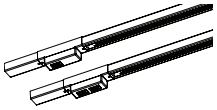


End Cap is used for mechanically ending any straight run, individual Track Section, or open configuration Track Section.

	Part Number
One Circuit Control	**TRK-S-AC-EC-Z**

Z=Paint Color
- ☐ **B**=Black
- ☐ **W**=White
- ☐ **S**=Silver

Current Limiter



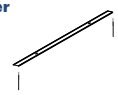
LSI Track Current Limiters integrate directly into one circuit runs. If using CONTROLTrack, data needs to be fed at another location. Available in the following amperages: 0.5 AMP (60 Watts), 1 AMP (120 Watts), 1.5 AMP (180 Watts), 2 AMP (240 Watts), 2.5 AMP (300 Watts), 3 AMP (360 Watts), 5 AMP (600 Watts), 8 AMP (960 Watts), 12 AMP (1440 Watts).

	Part Number
One Circuit Control	**TRK-SC-TCL1-XXX-120Z**

XXX =Amps
- ☐ **0.5**=0.5 AMPS
- ☐ **1.0**=1.0 AMPS
- ☐ **1.5**=1.5 AMPS
- ☐ **2.0**=2.0 AMPS
- ☐ **2.5**=2.5 AMPS
- ☐ **3.0**=3.0 AMPS
- ☐ **5.0**=5.0 AMPS
- ☐ **8.0**=8.0 AMPS
- ☐ **12.0**=12.0 AMPS

Z=Paint Color
- ☐ **B**=Black
- ☐ **W**=White
- ☐ **S**=Silver

Raceway Cover



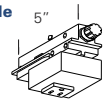
3' – 6 3/4"
7' – 6 3/4"
11' – 6 3/4"

Field cuttable Raceway Covers are used to enclose additional lay-in circuit wiring in top section of track. Raceway cover sections are nominal.

	Part Number
All Circuits	**TRK-S-AC-RCZZ-S**

ZZ=Length
- ☐ **04**=4ft Track
- ☐ **08**=8ft Track
- ☐ **12**=12ft Track

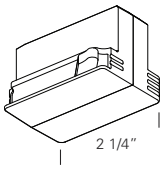
Power Receptacle Adapter



120/250V Power Receptical Adapter provides a convenient switched and fused U-Ground receptacle for power and is rated at 5A-120V. ETL listed.

Finish		Part Number
Black	One & Two Ckt	**31260**
White	One & Two Ckt	**31360**
Silver	One & Two Ckt	**31160**

Portable DMX Terminator



Terminates the end of a DMX run with a 120 ohm resistor. Lexan fixture fitting for installation in CONTROLTrack. See DMX guidelines for more information.

	Part Number
One Circuit Control	**TRK-DMX-TERM-Z**

Z=Paint Color
- ☐ **B**=Black
- ☐ **W**=White
- ☐ **S**=Silver

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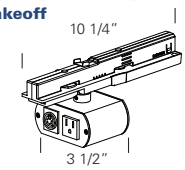
SURFACE CONTROLTrack • COMPONENTS

Power Receptacle Adapter + Data Takeoff



120V/250 Power Receptacle Adapter with 5 pin XLR connector for data takeoff. Consult factory for 277V.

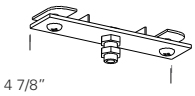
	Part Number
One Circuit Control	**TRK-SC-TO-120Z**
	Z=Paint Color ☐ **B**=Black ☐ **W**=White ☐ **S**=Silver

Display Hook

Display Hook is used to mechanically hang an item from the track without electrifying it. Do not exceed 20 lbs. at minimum spacing of two feet.

Finish		Part Number
Silver	One & Two Ckt	**30761**

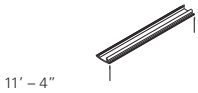
Weight Support Bar



Weight Support Bar provides threaded nipple and nuts to mount an item to track without electrifying it. Do not exceed 20 lbs. at minimum spacing of two feet. Nipple size 1/8-27 NPS (.406 diameter).

Finish		Part Number
Silver	One & Two Ckt	**30762**

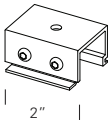
Track Closure Cover



Field cuttable Noryl Track Closure Covers are used to enclose the open face of the track, and simply snap into place.

	Part Number
All Circuits	**TRK-S-AC-TC12-Z**
	Z=Paint Color ☐ **B**=Black ☐ **W**=White ☐ **S**=Silver

Surface Hanger Clip



Extruded Surface Hanger Clips space track .50" (13mm) from a surface to create a floating look or when mounting to an uneven surface. For normal usage, LSI recommends two hanger clips per 4 foot (1.2m) length, two hanger clips per 8 foot (2.4m) length, and three hanger clips per 12 foot (3.7m) length. Two clips per package. ¼" diameter hole.

Finish		Part Number
Black	One & Two Ckt	**30225**
White	One & Two Ckt	**30325**
Silver	One & Two Ckt	**30025**

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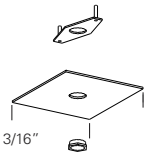
SURFACE CONTROLTrack • COMPONENTS

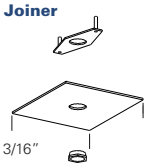
Flush Canopy Kit for End Feed



The canopy kit for End Feed is used when flush mounting track to a surface and feeding from a recessed outlet box.

	Part Number
All Circuits	**TRK-S-AC-CKE-Z**
	Z=Paint Color
	☐ **B**=Black
	☐ **W**=White
	☐ **S**=Silver

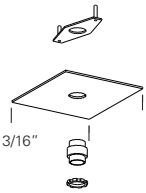
Flush Canopy Kit for Straight Joiner



The canopy kit for Straight Joiner/Feeder is used when flush mounting track to a surface and feeding from a recessed outlet box.

	Part Number
All Circuits	**TRK-S-AC-CKJ-Z**
	Z=Paint Color
	☐ **B**=Black
	☐ **W**=White
	☐ **S**=Silver

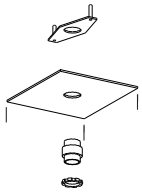
Canopy Kit for End Feed when using Surface Hanger Clips



The Canopy Kit for End Feed is required when using Surface Hanger Clips to enclose wiring to track End Feed which is spaced .50 (13mm) from recessed outlet boxrecessed outlet box.

Finish		Part Number
Black	One & Two Ckt	**30226**
White	One & Two Ckt	**30326**
Silver	One & Two Ckt	**30026**

Canopy Kit for Straight Joiner/Feeder when using Surface Hanger Clips



The Canopy Kit for Straight, L, T and X Joiner/Feeder is required when using Surface Hanger Clips to enclose wiring to track joiners which are spaced .50 (13mm) from recessed outlet box.

Finish		Part Number
Black	One & Two Ckt	**30227**
White	One & Two Ckt	**30327**
Silver	One & Two Ckt	**30027**

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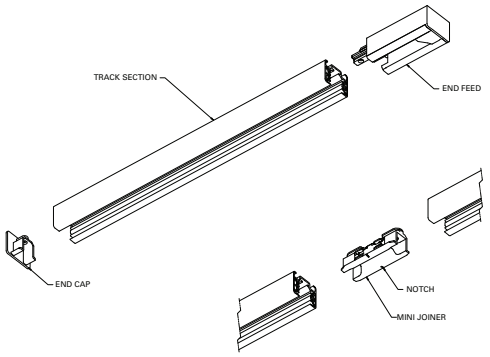
SURFACE CONTROLTrack • INSTALLATION INSTRUCTIONS

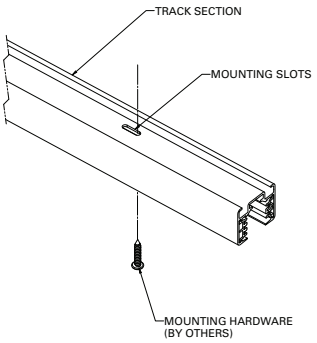
IMPORTANT SAFETY INSTRUCTIONS - For use with CONTROLTrack System Only
When installing or using this track system, basic safety precautions should always be followed, including the following: **Read all instructions.** Do not install this track in damp or wet locations. Do not install any part of the track system less than five feet from floor. Do not install any fixture assembly closer than six inches from any curtain or similar combustible material. Disconnect electrical power before adding to or changing the configuration of the track. Check with a qualified electrician. Do not attempt to energize anything other than lighting track fixtures on the track. To reduce the risk of fire and electric shock, do not attempt to connect power tools, extension cords, appliances and the like to the track. Do not connect a track to more than one branch circuit unless the track is constructed so it can be used with more than one branch circuit. Check with a qualified electrician. Although the track lighting system may seem to operate acceptably, a dangerous overload of the neutral may occur and result in a risk of fire. Install per NEC and local codes. **SAVE THESE INSTRUCTIONS**



Assembling

Insert End Cap, End Feed or any other Joiner/Feeder completely into Track Section and tighten the recessed Phillips head screw. Do not use excessive force when inserting components into Track Section.

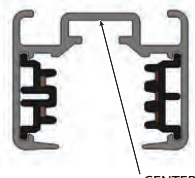
Note: Insert Mini Joiner into track up to centering notch.

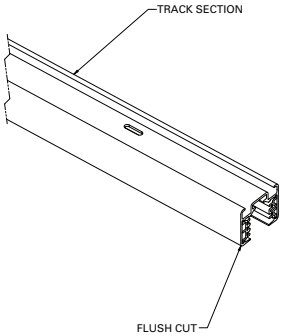


Mounting

Fasten track directly to surface through pre-punched mounting slots with hardware (by others) capable of withstanding a 50 lb. pull. Mount track in compliance with NEC Lighting Track Article #410-101 (Installation), #410-104 (Fastening) and any other applicable codes. To prevent distortion of the track opening which may prevent insertion of fixture fittings, do not over tighten mounting screws. LSI recommends a minimum of two mounting points per section of track. LSI CONTROLTrack can be mounted on centers up to 6'- 0".

LSI CONTROLTrack can also be mounted by surface hanger clips, stems, or cables on centers up to 6' 0". LSI recommends a minimum of two mounting points per section of track. Pendant mounted track intended to be installed by stems only are not to be mounted by cable.





Field Cutting

LSI CONTROLTrack can be easily field cut using a sharp hacksaw or a chop saw with a blade for non-ferrous metals, such as Oldham commercial carbide series metal blade. Together, cut the aluminum track, track liner, and copper with one straight cut. All pieces must be exactly the same length. Be sure to remove any burrs on the aluminum or the copper as this may affect the electrical and mechanical interconnection of components to track. Do not cut track to less than one foot in length.

LSI CONTROLTrack can easily be field drilled by using the drill guide and a 3/16" drill bit. Be sure to remove any burrs after drilling. A single section of track that is 4 feet (1.22 m) or less in length is to be provided with one mounting opening spaced a maximum of 6 inches (152.4 mm) from each end of a track section. Additional openings may be provided. A single section of track that is greater than 4 feet (1.22 m) in length is to be provided with a mounting opening spaced a maximum of 12 inches (300 mm) from each end of the track section with additional openings being provided a minimum of every 6 feet (1.83 m) along the length of the track section.

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SURFACE CONTROLTrack • INSTALLATION

Electrical

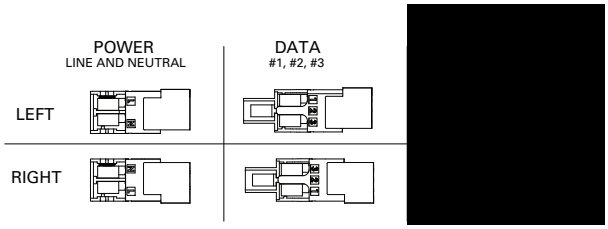
Remove the Lexan™ cover from any End Feed or Joiner/Feeder, bring wires through the combination 1/2, 3/4 U.S. trade size knock-out (.875 diameter [22mm], 1.125 diameter, [29mm]) in conduit plate and attach conductors to identified terminals on connectors. Joiner/Feeders can be electrically field modified by switching connector location. #12 THHN wire for Power and #18 THHN wire for data is the suggested size of wire.

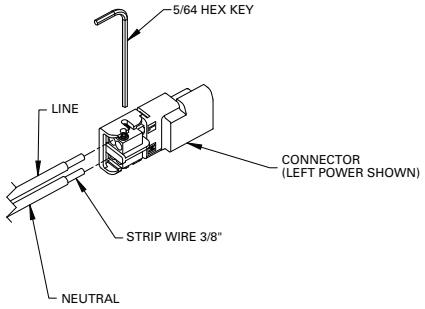
L = Line
N = Neutral

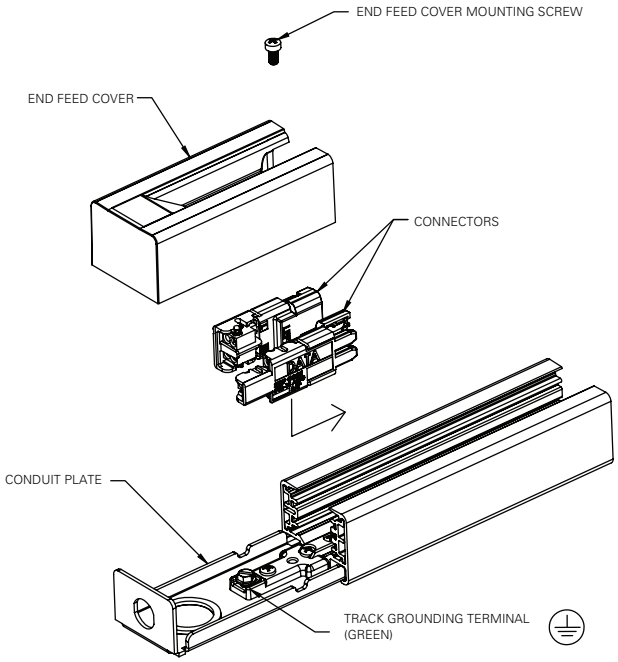
= Ground

Data Connections
#1 = DMX Common or 0-10V Common
#2 = DMX -, or 0-10V + (zone 1)
#3 = DMX +, or 0-10V + (zone 2)

NOTE:
ALL SUPPLIED CONNECTORS MUST BE INSTALLED EVEN IF NOT BEING WIRED. ENGAGING FIXTURE POWER OR DATA ROTORS WILL CAUSE INNER LINER TO SHIFT IF ALL CONNECTORS ARE NOT INSTALLED.







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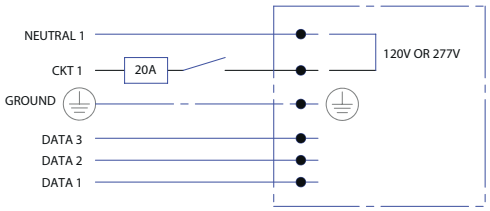
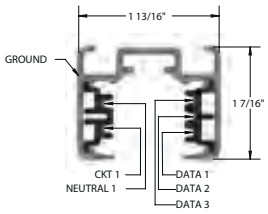
SURFACE CONTROLTrack • INSTALLATION

Supply Connection Wiring Diagram

Voltage = Single Phase 120V or 277V AC
Maximum Current = 20A per circuit Supply
Cable = 5 x 12 Gage THHN wire
CAUTION: Data MAX 30V, 2A

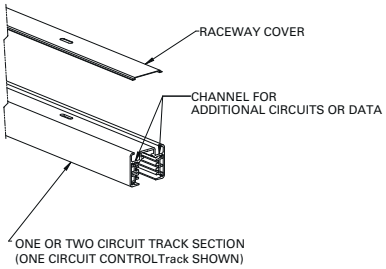




Additional Circuits

LSI Track has integral wiring channels for six additional #12 THHN wires to create three additional 20 amp circuits with separate neutrals or extra data wires. Place conductors in wiring channels and slide raceway covers into track prior to mounting.

DO NOT install power and data wires in the same raceway channel.

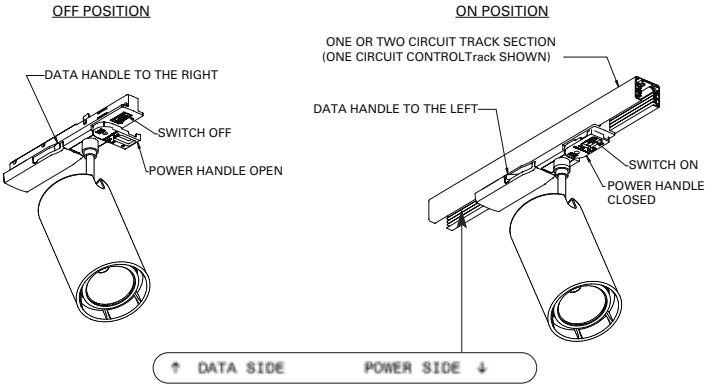


Installing LSI Fixtures

LSI CONTROLTrack is only to be used with LSI electrical fittings listed below:
-CT1
-CT2
-CT3
-CT4

CONTROLTrack is backwards compatible with —00 and —0E fittings

To insert a fixture fitting into the track, the switch must be in the "off" position, with the power handle open. Insert the fixture fitting straight up into the track until it seats evenly, close handle completely, switch on. If using CONTROLTrack, a second data handle will also need to be turned counterclockwise.
If using one circuit track or CONTROLTrack, make sure that the brass contacts which protrude from the side of the fixture fittings are inserted facing the copper busbars. CONTROLTrack handles will not engage if installed backwards. CONTROLTrack comes with a label inside track backbone to identify power and data.



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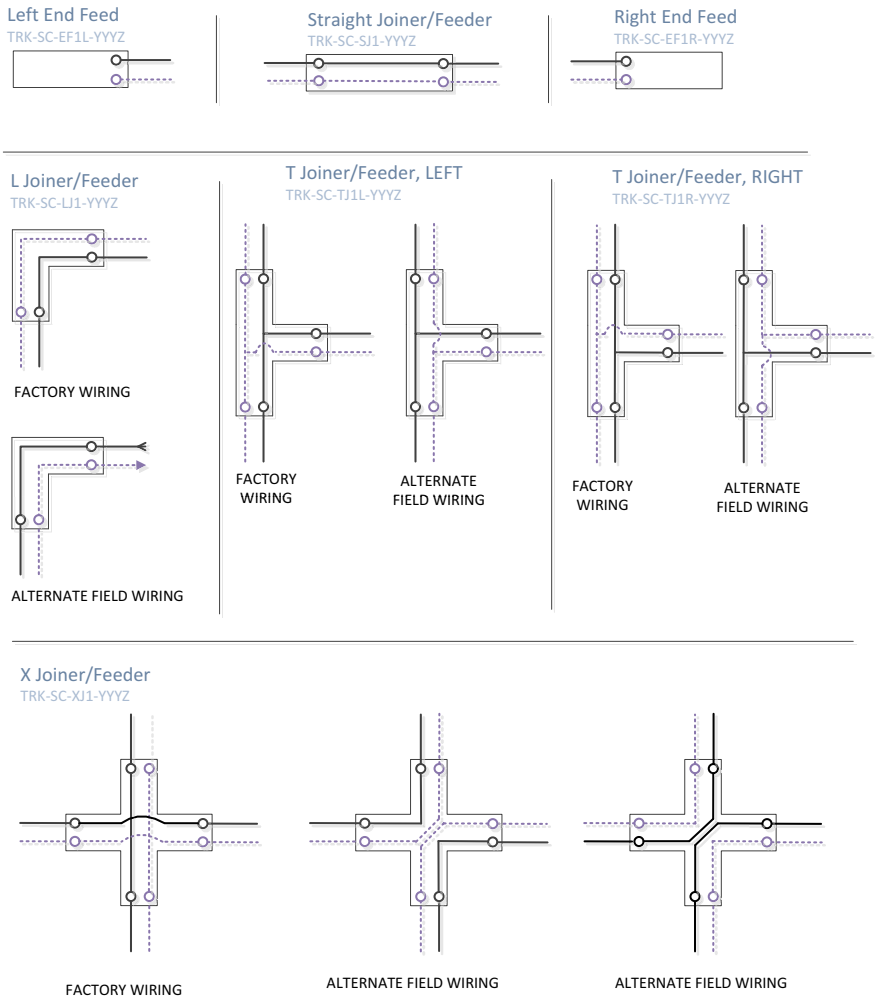
SURFACE CONTROLTrack • WIRING DIAGRAM

Diagrams apply to 0-10V and Lutron Ecosystem



POWER
DATA

NOTE:
ALL DIAGRAMS SHOWN ARE INSTALLED VIEW, NOT RCP. EXCEPT AS NOTED, ALL MODIFICATIONS CAN BE DONE SIMPLY AND QUICKLY ON THE JOB BY REARRANGING THE SUPPLIED CONNECTORS.

NOTE:
ALL JOINER/FEEDERS CAN BE FIELD MODIFIED TO SUIT INSTALLED REQUIREMENTS FOR MULTIPLE POWER CIRCUIT AND DIMMING ZONES. CONSULT FACTORY FOR MORE DETAILS.

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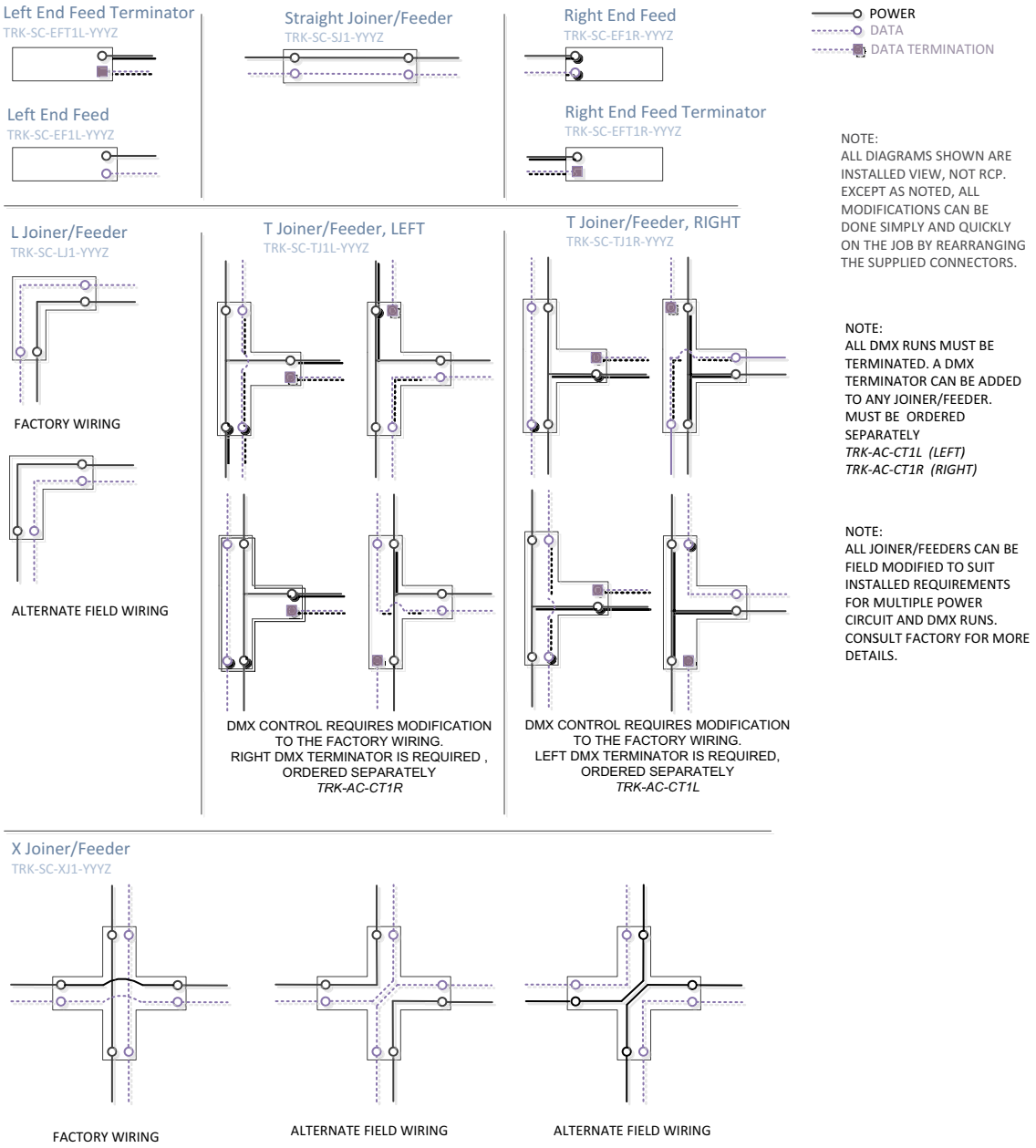
SURFACE CONTROLTrack • WIRING DIAGRAM

Diagrams apply to DMX



NOTE:
ALL DIAGRAMS SHOWN ARE INSTALLED VIEW, NOT RCP. EXCEPT AS NOTED, ALL MODIFICATIONS CAN BE DONE SIMPLY AND QUICKLY ON THE JOB BY REARRANGING THE SUPPLIED CONNECTORS.

NOTE:
ALL DMX RUNS MUST BE TERMINATED. A DMX TERMINATOR CAN BE ADDED TO ANY JOINER/FEEDER. MUST BE ORDERED SEPARATELY
TRK-AC-CT1L (LEFT)
TRK-AC-CT1R (RIGHT)

NOTE:
ALL JOINER/FEEDERS CAN BE FIELD MODIFIED TO SUIT INSTALLED REQUIREMENTS FOR MULTIPLE POWER CIRCUIT AND DMX RUNS. CONSULT FACTORY FOR MORE DETAILS.

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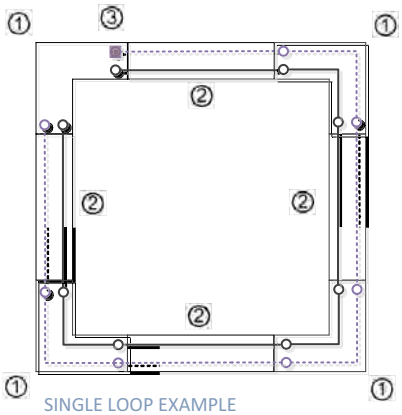
SURFACE CONTROLTrack • WIRING DIAGRAM

Diagrams apply to DMX

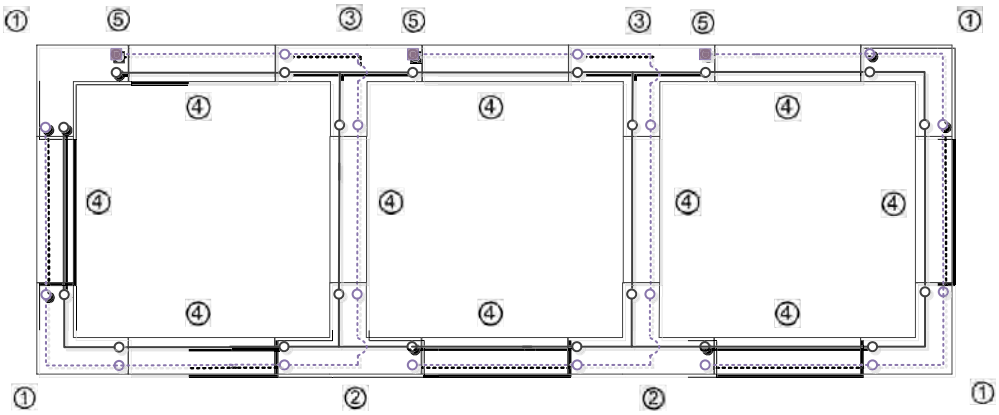
POWER
DATA
DATA TERMINATION



SINGLE LOOP EXAMPLE

NOTE:
1. ALL JOINER/FEEDERS CAN BE FIELD MODIFIED TO SUIT INSTALLED REQUIREMENTS FOR MULTIPLE POWER CIRCUIT AND DMX RUNS. CONSULT FACTORY FOR MORE DETAILS.
2. A DMX CONFIGURATION MAY REQUIRE MULTIPLE RUNS OF DMX. IN ORDER TO EMITIGATE THIS THE INTEGRAL RACEWAY TO JUCTION BOXES MAY BE USED TO DAISY CHAIN THE DATA LINES. 32 FIXTURES PER DMX RUN SHOULD BE FOLLOWED.

PARTS LIST
1. TRK-SC-LJ1-YYYZ – L JOINER, 4X (1 IS FIELD MODIFIED TO ACT AS FEEDER/TERMINATOR)
2. TRK-SC-XX1-YYYZ – SURFACE CONTROLTrack SECTION, 4X
3. TRK-AC-CT1L – CONNECTOR TERMINATOR, 1X



1 X 3 GRID EXAMPLE

PARTS LIST
1. TRK-SC-LJ1-YYYZ – L JOINER, 4X (1 IS FIELD MODIFIED TO ACT AS FEEDER/TERMINATOR)
2. TRK-SC-TJ1L-YYYZ – T JOINER LEFT, 2X (BOTH ARE FIELD MODIFIED TO REMOVE THE "Y" IN DMX DATA)
3. TRK-SC-TJ1R-YYYZ – T JOINER RIGHT, 2X (BOTH ARE FIELD MODIFIED TO ACT AS TERMINATOR)
4. TRK-SC-XX1-YYYZ – SURFACE CONTROLTrack SECTION, 10X
5. TRK-AC-CT1L – CONNECTOR TERMINATOR, 3X

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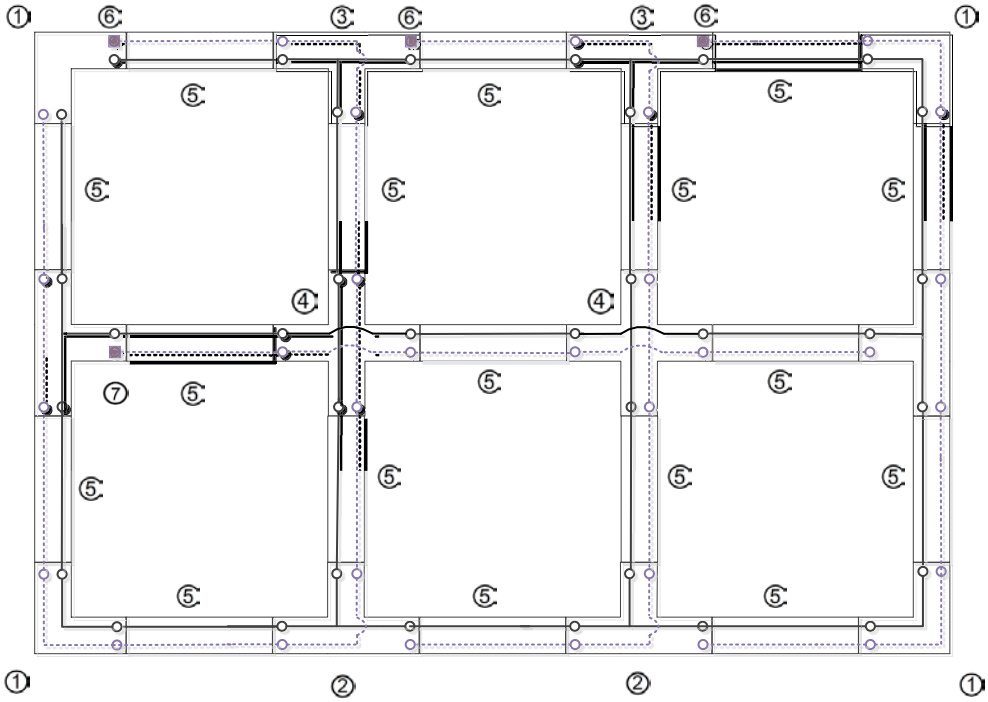
SURFACE CONTROLTrack • WIRING DIAGRAM

Diagrams apply to DMX

NOTE:
1. ALL JOINER/FEEDERS CAN BE FIELD MODIFIED TO SUIT INSTALLED REQUIREMENTS FOR MULTIPLE POWER CIRCUIT AND DMX RUNS. CONSULT FACTORY FOR MORE DETAILS.
2. A DMX CONFIGURATION MAY REQUIRE MULTIPLE RUNS OF DMX. IN ORDER TO EMITIGATE THIS THE INTEGRAL RACEWAY OR JUCTION BOXES MAY BE USED TO DAISY CHAIN THE DATA LINES. 32 FIXTURES PER DMX RUN IS THE MAXIMUM.

POWER
DATA
DATA TERMINATION



2 X 3 GRID EXAMPLE

PARTS LIST
1. TRK-SC-LJ1-YYYZ – L JOINER, 4X (1 IS FIELD MODIFIED TO ACT AS FEEDER/TERMINATOR)
2. TRK-SC-TJ1L-YYYZ – T JOINER LEFT, 3X (BOTH ARE FIELD MODIFIED TO REMOVE THE "Y" IN DMX DATA)
3. TRK-SC-TJ1R-YYYZ – T JOINER RIGHT, 3X (BOTH ARE FIELD MODIFIED TO ACT AS TERMINATOR)
4. TRK-SC-XJ1-YYYZ – X JOINER, 2X
5. TRK-SC-XX1-YYYZ – SURFACE CONTROLTrack SECTION, 17X
6. TRK-AC-CT1L – CONNECTOR TERMINATOR, 3X (left)
7. TRK-AC-CT1R – CONNECTOR TERMINATOR, 1X (right)

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GENERAL

- CAUTION: Data lines only for low voltage, 30V 2A
- CAUTION: Data and Power should to be installed into separate feeds to prevent unstable data transmission. AC voltages may induce interference on low voltage wiring when run in the same conduit. Analog (0-10V) is more susceptible than digital communication (DMX, etc.). Shielded pair cable is suggested for data runs with shielding grounded to earth at the controller.

0-10V

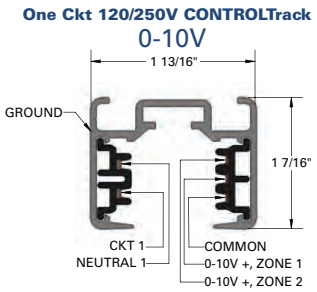
- One or Two 0-10V control zones may be installed in single track run. Common wires can be connected together at feed. Maximum fixture quantity is dependent on the capacity of the controller. The length of 0-10V (analog) wiring on 18ga wire is 300ft.

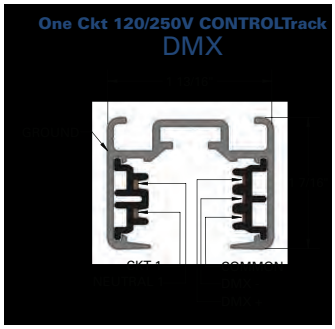
DMX

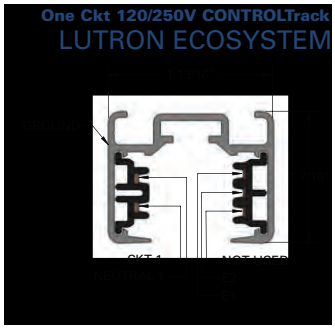
- DMX wiring must be installed to standard protocols (DMX-512A (ANSI E.1.11) or data transmission may become unstable. Maximum number of DMX fixtures on a single data run is 32. Maximum number of RDM fixtures on a single data run is 20. No loops, 'Y's, or stars in the DMX data path that would disrupt data transmission. Each DMX data run needs be terminated with a 120-ohm resistor or the use of a mini terminator
- Each DMX run should not exceed 1000ft. DMX cable should meet RS485 standard.

Lutron EcoSystem

- Maximum number of Lutron EcoSystem fixtures on a single data run is 64. Loops in the Lutron EcoSystem data path are NOT allowed. Y's and branches are allowed.
- Lutron EcoSystem data run should not exceed 570ft on 18ga wire.







Data Terminal	0-10V	DMX	Lutron EcoSystem
1	Common	Common	N/A
2	+, Control Zone 1	-	-
3	+, Control Zone 2	+	+

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Construction Document

Type

T1

Cut sheet 15 of 15

LP2 • 120/277V • LED • COB • CONTROLTrack COMPATIBLE

Shown with optional cross baffle accessory

This versatile spotlight creates a high intensity shaft of light that is perfect for long-throw applications.

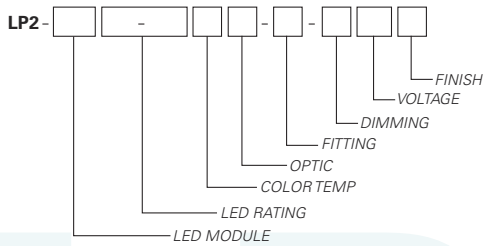
- 4° optic produces 180,000 CBCP with 2180 lumens at 30 watts
- System efficiency up to 66 lumens/watt
- Exceeds ANSI specifications by maintaining extremely tight color consistency over the life of the fixture
- Tested to LM79 and LM80 Protocols
- 50,000 hour life to 70% lumen output, L_{70} at 95°F max ambient
- 0-10V dimming allows for 2 zones of control on one circuit CONTROLTrack down to 10%
- DMX compatible with dimming below 1%
- Choice of beam spread (fixed optics)
- Color Rendering Index (CRI) 90+
- Color consistency, 2 MacAdam ellipse
- No UV or IR emissions; no mercury or lead
- On/off safety switch (on most mounting types)
- Field replaceable, connector-less LED module
- Sturdy aluminum housing
- Self locking vertical and horizontal focusing
- Internal multiple accessory clips accept E size LSI gels and accessories
- Finishes: LSI Black, White, and Silver
- Fixture weight: 5 lbs

FIXTURE PART NUMBERS

Please review the **ORDERING INFORMATION** section on the next page as well as the **MOUNTING OPTIONS** on page 3 to create a part number for each fixture that specifies the following:

- LED Module
- LED Rating
- Color Temperature
- Optic (mm/beam spread)
- Fitting (Mounting Option)
- Dimming
- Voltage
- Finish

PART NUMBER



Example Part Number: **LP2-ZE822-903004-CT3-DX120W** is a fixture with an 8 LED Array module, 2180 Lumen/90 CRI/30 Watt LED rating, 3000°K Color Temperature, 35mm 4° Optic, CT3 CONTROLTrack fitting with DMX Address knobs and DMX compatible control gear, 120V and a White finish.

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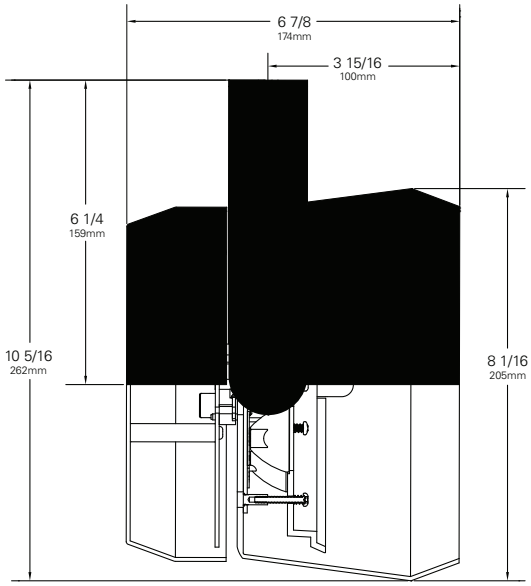
Type

TA

Cut sheet 1 of 9

LP2 • 120/277V • LED • COB • CONTROLTrack COMPATIBLE



ORDERING INFORMATION

Base Fixture Model

☐ LP2-ZE8

LED Rating (Lumens/CRI/Wattage)

☐ 22-90 = 2180/90/30

Color Temperature

☐ 27 = 2700K ☐ 30 = 3000K ☐ 35 = 3500K

Optic

☐ 04 = 35mm/ 4° ☐ 12 = 35mm/ 12° ☐ 25 = 35mm/ 25°

Fitting/Controls (Dimming)

☐ CT1-10 = CONTROLTrack Fitting & 0-10V (10%)

☐ CT1-L3 = CONTROLTrack Fitting & Lutron Ecosystem (1% soft on/off)

☐ CT3-DX = CONTROLTrack Fitting & DMX (<1%)

Voltage

☐ 120 = 120V ☐ 230 = 220-240V ☐ 277 = 277V

Finish

☐ B = Black ☐ W = White ☐ S = Silver

LP2-ZE8	22-90	30	04	– CT3-DX	120	W
FIXTURE MODEL	LED RATING	COLOR TEMP	OPTIC	FITTING/ DIMMING	VOLTAGE	FINISH

Other Options (Consult Factory):

- Custom Stems, specify length (4”- 48”)
- Custom Finish, RAL palette

DRIVER TYPE (Electronic)

Input Power (A) - 120V	0.13
Input Power (A) - 277V	0.05
Wattage	15
Power Factor - 115V	0.95

Chromaticity Specifications

LED	R_a-CRI	R_f-Fidelity	R_g-Gamut Area
ZE4	90	92	102

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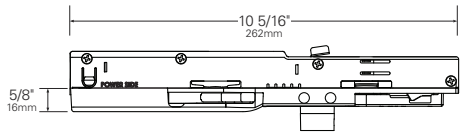
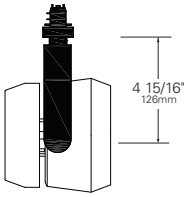
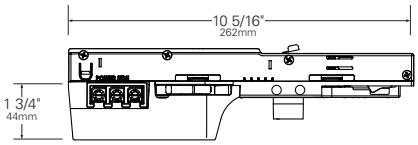
Cut sheet 2 of 9

LP2 • MOUNTING OPTIONS

FITTING	SIDE VIEW	PROFILE VIEW
CT1 CONTROLTrack Fitting		
CT3 CONTROLTrack Fitting		

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Type

TA

Cut sheet 3 of 9

LP2 • PERFORMANCE

The performance characteristics of the LP SuperSPOT family of products can be customized based on the LED module and the optic selected.

Each available LED module is defined by four characteristics – the color rendering index (CRI), the correlated color temperature (CCT), the power that it uses (watts), its "available lumens" and beam spread. Note that available lumens is a theoretical value that represents the light output of the module on its own – no fixture or optic attached.

In the LSI part number, the LED module is specified with a letter and a number that immediately follow the product series number. For example, in the part number LP2-ZE822-903004-00-TE120B, the "**ZE822-903004**" represents an LED module with an output of 2180 lumens, a CRI of 90, a power usage of 30 watts, color temperature of 3000K and a 4-Degree beam.

Additional parameters, such as Center Beam Candle Power (CBCP), Delivered Lumens, and Efficiency (Lumens per Watt) are all shown in a table that is organized by LED module and optic combination.

CBCP = Center Beam Candle Power

LED Module	Optic (Reflector)		
Lumens/CRI/Wattage	**04°**	**12°**	**25°**
2180/90/30	180000	33000	9000

Delivered Lumens

LED Module	Optic (Reflector)		
Lumens/CRI/Wattage	**04°**	**12°**	**25°**
2180/90/30	990	1980	1900

Efficiency = Lumens Per Watt

LED Module	Optic (Reflector)		
Lumens/CRI/Wattage	**04°**	**12°**	**25°**
2180/90/30	33	66	63

LED Module **Lumens/CRI/Wattage** **SKU Code**	
Nominal Fixture Power (+/- 20%), Watts	30
Maximum Inrush Current Amps	10
Minimum Power Factor	0.92

Inrush current is instantaneous current drawn by the LED only when fixture is initially powered on or instantaneously changed from full dim to full bright. For more details see Dimming Application Sheet, IS-0119.

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Type

TA

Cut sheet 4 of 9

LP2 • PHOTOMETRIC DATA

PHOTOMETRIC DATA

LP2 Series

Beam Spread (minimum)	**4°**
Center Beam Candlepower	**180,000**
CRI	**90+**

LP2 Series (preliminary)

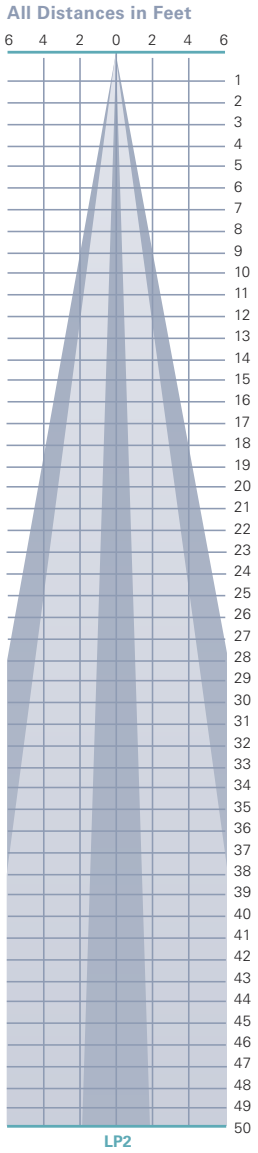
Beam Spread (minimum)	**12°**
Center Beam Candlepower	**33,000**
CRI	**90+**

LP2 Series (preliminary)

Beam Spread (minimum)	**25°**
Center Beam Candlepower	**9,000**
CRI	**90+**

All Max. Footcandles at 0° Beam Axis

25°	12°	4°
9000	33000	180000
2250	8250	45000
1000	3667	20000
563	2063	11250
360	1320	7200
250	917	5000
184	673	3673
141	516	2813
111	407	2222
90	330	1800
74	273	1488
63	229	1250
53	195	1065
46	168	918
40	147	800
35	129	703
31	114	623
28	102	556
25	91	499
23	83	450
20	75	408
19	68	372
17	62	340
16	57	313
14	53	288
13	49	266
12	45	247
11	42	230
11	39	214
10	37	200
9	34	187
9	32	176
8	30	165
8	29	156
7	27	147
7	25	139
7	24	131
6	23	125
6	22	118
6	21	113
5	20	107
5	19	102
5	18	97
5	17	93
4	16	89
4	16	85
4	15	81
4	14	78
4	14	75
4	13	72



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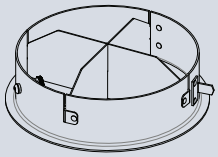
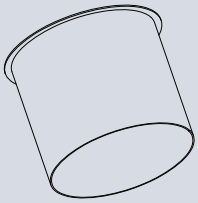
Cut sheet 5 of 9

LP2 • ACCESSORIES



LP2 CROSS BAFFLE

Internal insert with cross blades. Controls spill light and glare. Black finish.

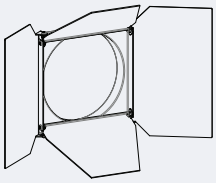


HOOD LP2*

6 inch deep hood. Interior flocking included to control spill light and glare. Black finish.

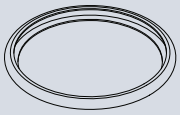
LOUVER HEX E

1/8" thick Hexcell black metal louver used for thin profile.



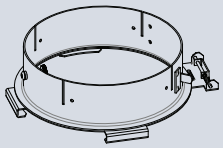
4-WAY BARNDOOR LP2*

4-way individually adjustable blades for control of light beam. Black finish.



BACKER RING E

Stainless steel ring to hold gel when no other size E accessory is being used.



LP2 HOLDER

External Accessory cartridge to hold LP2 hood and LP2 barndoor.
Black finish.

*LP2 Holder (External Accessory Cartridge) required

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Construction Document

Type

TA

Cut sheet 6 of 9

LP2 • GELS

As the foremost innovator in accent lighting, LSI offers a complete range of pre-cut Gels to modify the spread and color of light for the LumeLEX LED Series.

LumeLEX® SPREAD GELS

Size: E (158 mm diameter)	Spread Gel
GEL–L1–E	1° Spread Gel
GEL–L5–E	5° Spread Gel
GEL–L10–E	10° Spread Gel
GEL–L20–E	20° Spread Gel
GEL–L30–E	30° Spread Gel
GEL–L40–E	40° Spread Gel
GEL–L60–E	60° Spread Gel
GEL–L80–E	80° Spread Gel
GEL–L30B5–E	30° by 5° Spread Gel
GEL–L40B2–E	40° by 0.2° Spread Gel
GEL–L60B1–E	60° by 1° Spread Gel
GEL–L60B10–E	60° by 10° Spread Gel
GEL–L75B45–E	75° by 45° Spread Gel
GEL–L90B60–E	90° by 60° Spread Gel
GEL–R101–E	Beam Softener

LumeLEX® COLOR GELS

Size: E (158 mm diameter)	Gel Color	% of Light Transmission	Size: E (158 mm diameter)	Gel Color	% of Light Transmission
GEL–R2–E	Bastard Amber	78	GEL–R312–E	Canary	85
GEL–R7–E	Pale Yellow	96	GEL–R3204–E	Half Blue	52
GEL–R12–E	Straw	88	GEL–R331–E	Shell Pink	68
GEL–R13–E	Straw Tint	78	GEL–R383–E	Sapphire Blue	4
GEL–R14–E	Medium Straw	68	GEL–R397–E	Pale Grey	70
GEL–R21–E	Golden Amber	43	GEL–R2001–E	Storaro Red	12
GEL–R25–E	Orange Red	14	GEL–R2004–E	Storaro Green	15
GEL–R26–E	Light Red	12	GEL–R2009–E	Storaro Violet	3
GEL–R27–E	Medium Red	4	GEL–R3202–E	Full Blue	36
GEL–R57–E	Lavender	24	GEL–R3206–E	Third Blue	64
GEL–R62–E	Booster Blue	54	GEL–R3216–E	Eighth Blue (Boosts 3200K to 3300K)	81
GEL–R71–E	Sea Blue	30	GEL–R3318–E	Tough 1/8 Minusgreen	89
GEL–R72–E	Azure Blue	44	GEL–R3410–E	Roscosun (1/8 CTO) (Reduces 5500K to 4900K)	92
GEL–R91–E	Primary Green	7	GEL–R3441–E	Full Straw (CTS)	50
GEL–R97–E	Light Grey	50	GEL–R3443–E	Quarter Straw (CTS)	81
GEL–R98–E	Medium Grey	25	GEL–R4330–E	CalColor 30 Cyan	63
GEL–R101–E	Light Frost	N/A	GEL–R4415–E	CalColor 15 Green	67
GEL–R104–E	Tough Silk	N/A	GEL–R4490–E	CalColor 90 Green	25
GEL–R119–E	Lt. Hamburg Frost	N/A	GEL–R4860–E	CalColor 60 Pink	46
GEL–R121–E	Blue Diffusion	N/A	GEL–R4890–E	CalColor 90 Pink	38
GEL–R305–E	Rose Gold	75	GEL–R4930–E	CalColor 30 Lavender	47

* Backer Ring E required to hold gels when no other rimmed "E" accesories are used.

LSI ROSCO GEL CCT CONVERSION CHART FROM 3000K

Type	ROSCO #	ROSCO Description	Resulting CCT
Amber Filters Lower CCT	3420	Double CTO	1531
	3407	Sun CTO	1999
	3401	Sun 85	2154
	3411	Sun 3/4 CTO	2154
	3408	Sun 1/2 CTO	2414
	3409	Sun 1/4 CTO	2664
	3410	Sun 1/8 CTO	2830
	3114	UV Filter	2930
Blue Filters Raise CCT	3220	Double Blue	N/A
	3202	Full Blue	4942
	3203	Three-Quarter Blue	4286
	3204	Half Blue	3769
	3206	Third Blue	3517
	3208	Quarter Blue	3297
	3216	Eighth Blue	3112

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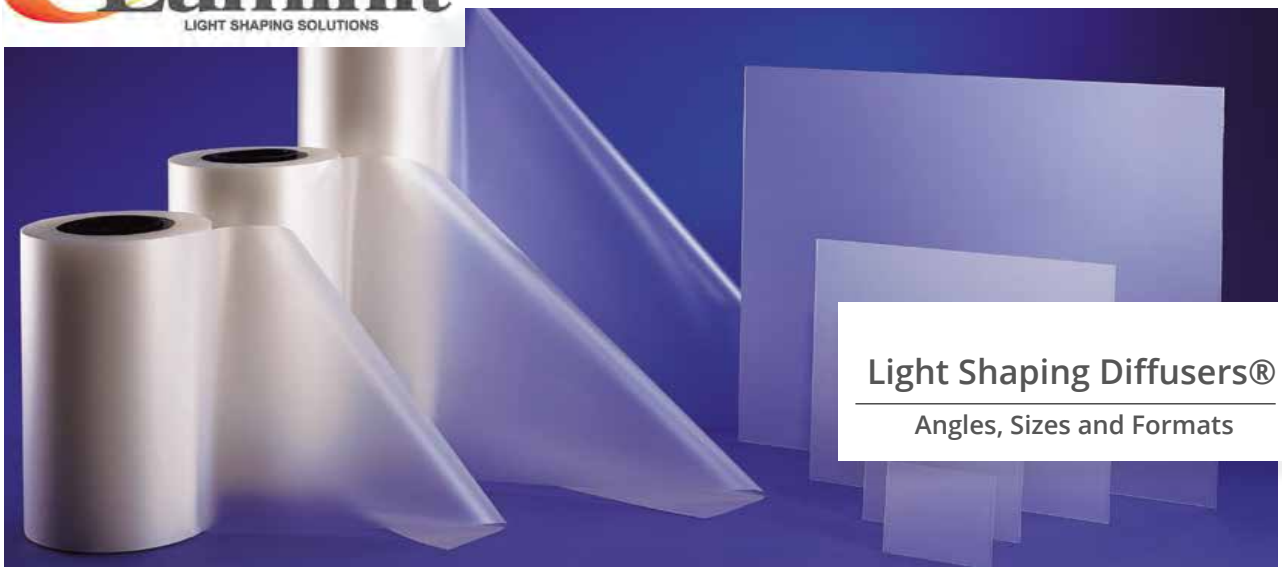
Type

TA

Cut sheet 7 of 9



Light Shaping Diffusers®

Angles, Sizes and Formats

Luminit Light Shaping Diffusers homogenize and directionally shape light with high transmission efficiency and excellent hiding power. Available in seamless rolls on polycarbonate, polyester or acrylic substrates, including UV-stable or UL-approved substrates, we offer diffusers with elliptic and circular outputs in a variety of substrates, sizes and angles from small to extreme. We can custom cut to your specifications, and offer low-cost Injection Molded (IM) lenses that can be designed in a variety of shapes and sizes in symmetrical and asymmetrical beam angles for any LED module design.

No Diffuser

30° Diffuser

30° X 5° Diffuser

60° X 1° Diffuser

Large Volume Seamless Rolls

Circular Angle (FWHM)	Elliptical Angle (FWHM)	Substrate & Thickness	Sizes	Options
80°	80° x 50°	**Polycarbonate**	**Roll Width**	Protective film
60°	60° x 30°	P1 – 0.010”	24” Wide	Partial rolls
30°	60° x 10°		Standard	available with
20°	60° x 1°		length = 500ft	50ft minimum
10°	50° x 3°			length
5°	40° x 10°			
3.5°	30° x 3°			
2°	30° x 1°			
1°	15° x 1°			
	1° x 60°			
	1° x 40°			

For more information, contact sales@luminitco.com
1850 W. 205th St. Torrance, CA 90501 | 310 320-1066

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Type

TA

Cut sheet 8 of 9

LSD Sheets and Panels

Circular Angle (FWHM)	Elliptical Angle (FWHM)	Substrate & Thickness	Sizes	Options
100° 80° 40° 30° 20° 10° 7.5° 5° 3.5° 2° 1° 0.5°	90° x 60° 95° x 25° 80° x 50° 75° x 45° 60° x 30° 60° x 10° 60° x 1° 40° x 1° 30° x 5° 30° x 1° 1° x 40°	**Polycarbonate** P1 – 0.010" P3 – 0.030" P6 – 0.060" P8 – 0.118" Polyester, acrylic, UVT acrylic substrates also available	12" x 12" Custom angles and larger sizes available on request	With PSA and Protective Film

Injection Molded Parts

Angles & Transmission	Material	Lens/Optics Sizes & Thickness	Minimum Qty.	Options
Standard LSD angles >85%	Polycarbonate, acrylic or other specified optical materials	Up to 6.5" in size 0.030 up to 0.125" thick	10,000 or more	Requires 6 weeks lead time

Direction Turning Film

Angle (FWHM)	Substrate & Thickness	Transmission Spectral Range	Sizes	Options
20°	Polycarbonate	400nm-800nm	24" x 24"	PSA **Protective Film**

P1- 0.010

Volumetric Light Shaping Diffusers for Linear Light Fixtures

Temp. Range	Material & Thickness (FWHM)	Diffusion Angles	BYK Transmission	Haze
-30°C to 80°C	PS 1.5MM (PMMA available by special request)	60°	80%*	102%

Glass Diffusers

Angle (FWHM)	Substrate & Thickness	Sizes	Options
50° 40° 30° 20° 15° 10 5° 1° 0.5°	**UV Fused Silica** U3 3mm **B270** G6 - 3mm	25mm 50mm 2" x 2"	Custom elliptical and circular angles as well as larger sizes can be made.

*As measured by a BYK Haze-Gard (ASTM D 1003)
Note that the specifications contained herein are subject to change without notice.

REV: 6-29-18

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Construction Document

Type

TA

Cut sheet 9 of 9

BPM • 120/277V • LED • CONTROLTrack

The miniature BPM series is a professional grade high output LED instrument with features such as 360 degree gate rotation, true "E" size gobo projection, 3 plane cool touch shutters and easily changed zoom lenses (narrow and wide).

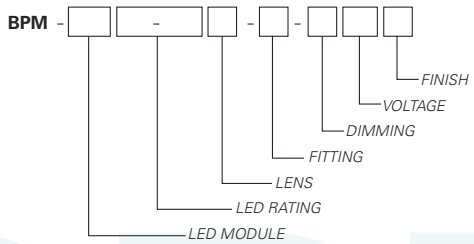
- 35,300 hour life to 70% lumen output, L70 at 95° max ambient
- Ideal for medium throw applications up to 20 feet
- Accepts industry standard, size "E" Gobo or custom projection patterns
- Fully rotatable lens barrel for easy image alignment
- Can be configured for use on 120, 230, or 277V systems
- Four cool-touch framing shutters on 3 planes for creating unlimited variations of geometric shapes, including true triangles
- Vertical and horizontal tool-less locking
- On/off safety switch (on most mounting types)
- 0-10V dimming allows for 2 zones of control on one circuit CONTROLTrack down to 10%
- DMX compatible with dimming below 1%
- Integral drop-in accessory cartridge accepts dichroic color filters and accessories (Industry size E; LSI size BPM)
- Locking zoom lens produces smooth, continuous change of beam size (Choose narrow beam or wide beam lens) 20° through 60°
- Spring loaded front accessory holder for gel media
- Finishes: LSI Black, White, and Silver
- Fixture weight: 3.5 lbs.

FIXTURE PART NUMBERS

Please review the **ORDERING INFORMATION** section on the next page as well as the **MOUNTING OPTIONS** on page 3 to create a part number for each fixture that specifies the following:

- LED Module
- LED Rating
- Lens
- Fitting (Mounting Option)
- Dimming
- Voltage
- Finish

PART NUMBER



Example Part Number: **BPM-C0615-9030W-CT3-DX120W** is a fixture with a COB LED module, 1500 Lumen/90 CRI/ 3000°K Color Temperature/19 Watt LED rating, Wide Angle Lens Assembly, CT3 CONTROLTrack fitting with DMX Address knobs and DMX compatible control gear, 120V and a Black finish.

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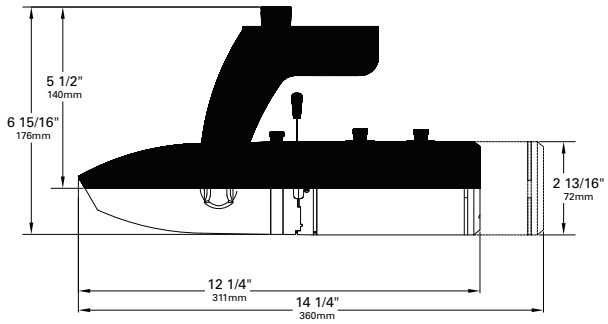
Construction Document

Type

TC

Cut sheet 1 of 8

BPM • 120/277V • LED • CONTROLTrack



ACCESSORIES

Other accessories:

- **Glass Dichroic Color Filters BPM**
- **Color and Spread Gels BPMFR**

LENS SYSTEMS

Narrow Beam Lens Assembly
BPMNL range: 20°-31° Length: 14-1/4" (overall length, fixture and lens) Specify finish.

Wide Beam Lens Assembly
BPMWL range: 36°-60° Length: 12-1/4" (overall length, fixture and lens) Specify finish.

ORDERING INFORMATION

Base Fixture Model

☐ BPM-C06 (COB 6mm)

LED Rating (Lumens/CRI//Color Temperature/Wattage)

☐ 17-8027 = 1725/80/2700K/19
☐ 15-9027 = 1500/90/2700K/19
☐ 18-8030 = 1856/80/3000K/19
☐ 15-9030 = 1500/90/3000K/19
Consult factory for other color temperatures

Choose the alpha code to designate the desired

Lens Assembly

☐ **(N)** for Narrow Angle (20°-31°)
☐ **(W)** for Wide Angle (36°-60°)
☐ **(Z)** for No Lens (BPM unit with no lens)

Select your **Fitting/Controls (Dimming)**

☐ CT1-10 = CONTROLTrack Fitting & 0-10V (10%)
☐ CT3-DX = CONTROLTrack Fitting & DMX (<1%)

Voltage

☐ 120 = 120V ☐ 230 = 220-240V ☐ 277 = 277V

Finish

☐ B = Black ☐ W = White ☐ S = Silver

BPM	-	C06	15-9030	W	-	CT3-DX	120	B
FIXTURE		LED MODULE	LED RATING	LENS		FITTING/DIMMING	VOLTAGE	FINISH

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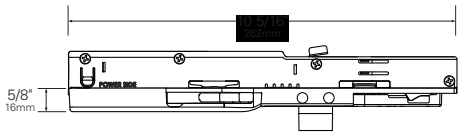
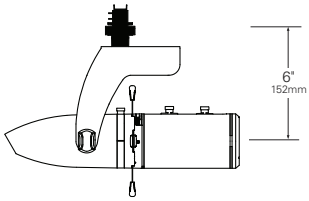
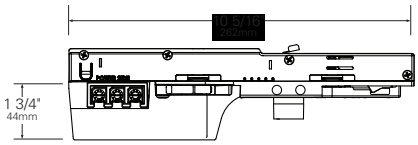
Cut sheet 2 of 8

BPM • MOUNTING OPTIONS

FITTING	SIDE VIEW	PROFILE VIEW
CT1 CONTROLTrack Fitting		
CT3 CONTROLTrack Fitting		

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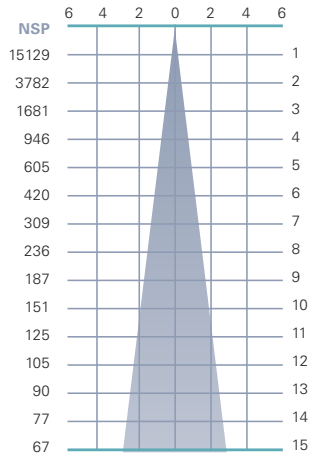
BPM • PHOTOMETRIC DATA

All Max. Footcandles at 0° Beam Axis

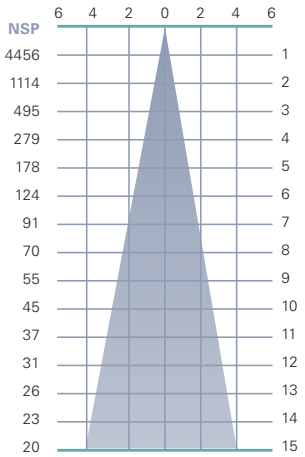
All Distances in Feet



BPM (18-8030) - Narrow Lens

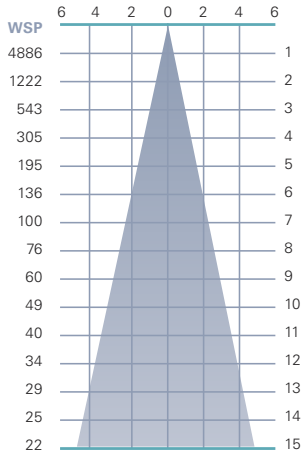
Beam spread (Minimum)	**20°**
Center beam candlepower	**15129**

All Distances in Feet



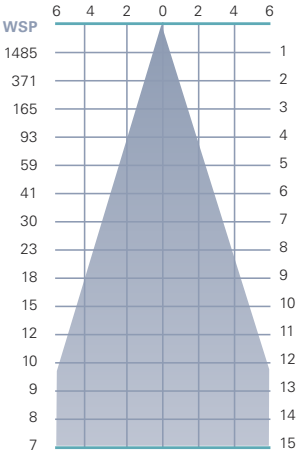
BPM (18-8030) - Narrow Lens

Beam spread (Maximum)	**31°**
Center beam candlepower	**4456**



BPM (18-8030) Wide Lens

Beam spread (Minimum)	**36°**
Center beam candlepower	**4886**



BPM (18-8030) Wide Lens

Beam spread (Maximum)	**60°**
Center beam candlepower	**1485**

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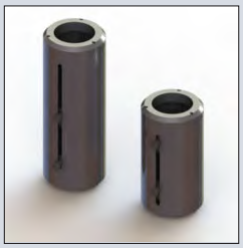
BPM • ACCESSORIES



LENS SYSTEMS

Narrow Beam Lens Assembly
BPMNL range: 20°-31°
Length: 14-1/4" (overall length, fixture and lens) Specify finish.

Wide Beam Lens Assembly
BPMWL range: 36°-60°
Length: 12-1/4" (overall length, fixture and lens) Specify finish.

For custom GOBOS, please contact:
ROSCO: www.rosco.com
GAM: www.gamonline.com
APOLLO: www.apollodesign.net/gobos
Size E Gobo (37.5mm OD x 28mm Image)

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Cut sheet 5 of 8

BPM • GELS

As the foremost innovator in accent lighting, LSI offers a complete range of pre-cut Gels to modify the spread and color of light.

BPM SPREAD GELS

Size: BPMFR	Spread Gel
GEL–L1–BPMFR	1° Spread Gel
GEL–L5–BPMFR	5° Spread Gel
GEL–L10–BPMFR	10° Spread Gel
GEL–L20–BPMFR	20° Spread Gel
GEL–L30–BPMFR	30° Spread Gel
GEL–L40–BPMFR	40° Spread Gel
GEL–L60–BPMFR	60° Spread Gel
GEL–L80–BPMFR	80° Spread Gel
GEL–L30B5–BPMFR	30° by 5° Spread Gel
GEL–L40B2–BPMFR	40° by 0.2° Spread Gel
GEL–L60B1–BPMFR	60° by 1° Spread Gel
GEL–L60B10–BPMFR	60° by 10° Spread Gel
GEL–L75B45–BPMFR	75° by 45° Spread Gel
GEL–L90B60–BPMFR	90° by 60° Spread Gel
GEL–R101–BPMFR	Beam Softener

BPM COLOR GELS

Size: BPMFR	Gel Color	Size: BPMFR	Gel Color
GEL–R2–BPMFR	Bastard Amber	GEL–R312–BPMFR	Canary
GEL–R7–BPMFR	Pale Yellow	GEL–R3204–BPMFR	Half Blue
GEL–R12–BPMFR	Straw	GEL–R331–BPMFR	Shell Pink
GEL–R13–BPMFR	Straw Tint	GEL–R383–BPMFR	Sapphire Blue
GEL–R14–BPMFR	Medium Straw	GEL–R397–BPMFR	Pale Grey
GEL–R21–BPMFR	Golden Amber	GEL–R2001–BPMFR	Storaro Red
GEL–R25–BPMFR	Orange Red	GEL–R2004–BPMFR	Storaro Green
GEL–R26–BPMFR	Light Red	GEL–R2009–BPMFR	Storaro Violet
GEL–R27–BPMFR	Medium Red	GEL–R3202–BPMFR	Full Blue
GEL–R57–BPMFR	Lavender	GEL–R3206–BPMFR	Third Blue
GEL–R62–BPMFR	Booster Blue	GEL–R3216–BPMFR	Eighth Blue (Boosts 3200K to 3300K)
GEL–R71–BPMFR	Sea Blue	GEL–R3318–BPMFR	Tough 1/8 Minusgreen
GEL–R72–BPMFR	Azure Blue	GEL–R3410–BPMFR	Roscosun (1/8 CTO) (Reduces 5500K to 4900K)
GEL–R91–BPMFR	Primary Green	GEL–R3441–BPMFR	Full Straw (CTS)
GEL–R97–BPMFR	Light Grey	GEL–R3443–BPMFR	Quarter Straw (CTS)
GEL–R98–BPMFR	Medium Grey	GEL–R4330–BPMFR	CalColor 30 Cyan
GEL–R101–BPMFR	Light Frost	GEL–R4415–BPMFR	CalColor 15 Green
GEL–R104–BPMFR	Tough Silk	GEL–R4490–BPMFR	CalColor 90 Green
GEL–R119–BPMFR	Lt. Hamburg Frost	GEL–R4860–BPMFR	CalColor 60 Pink
GEL–R121–BPMFR	Blue Diffusion	GEL–R4890–BPMFR	CalColor 90 Pink
GEL–R305–BPMFR	Rose Gold	GEL–R4930–BPMFR	CalColor 30 Lavender

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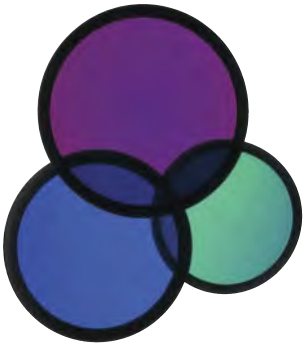
Cut sheet 6 of 8

COLOR MEDIA

DICHROIC COLOR FILTERS

In addition to our complete line of glass color filters, LSI now offers dichroic glass color filters that achieve purer, more saturated, richer color by selective wavelength transmission. Since these filters reflect rather than absorb the unwanted color wavelengths, a higher intensity of colored light can be obtained with fewer or lower wattage fixtures. In addition, this selective transmission allows for very accurate color matching from filter to filter.

All standard LSI filter sizes are available in a wide palette of well chosen dichroic colors that can be used with all LSI fixtures that accept accessories.



Size	Diameter	LSI Fixture Series
BPM (Industry size E)	37.5mm (1 1/2")	BPM

Technical Data

Dichroic color filters are created in a vacuum chamber by multi-layer vapor deposits of different minerals onto low expansion, chemically resistant Borosilicate glass.

Deposits are made in alternating layers of varying microscopic thickness which allow very narrow color wavelengths to be selectively transmitted and all other wavelengths to be reflected.

LSI does not recommend using dichroic color filters with lamps or fixtures that have beam spreads greater than 40° because a secondary color aura is created by the wide angular transmitted wavelengths that are different than the desired color wavelength.

Since there is mainly transmission and reflection of the color wavelengths by the dichroic filter and very little absorption, the dichroic filter can be used with many high temperature lights that normally would not accept color filters.

No.	Color	% of Light Transmission
2001	Light Pink	69
2002	Medium Pink	43
2003	Hot Pink	11
2004	Pale Pink	55
2010	Deep Magenta	29
2011	Lavender	24
2012	Vivid Magenta	31
2013	Lavender Accent	48
2014	Lilac	37
2015	Purple Fusion	12
2020	Sky Blue	39
2021	Sea Blue	39
2022	Cyan	33
2023	Light Blue Green	30
2024	Primary Blue	24
2025	Medium Red Blue	15
2026	Deep Purple	16
2027	Peacock Blue	53
2028	Mediterranean Blue	20
2029	Boost Blue	51
2040	Light Yellow Green	64
2041	Fern Green	47
2042	Turquoise	35
2043	Primary Green	31
2044	Industrial Green	64
2050	Yellow	80
2051	Amber	71
2052	Amber Blush	38
2053	Bastard Amber	71
2054	Goldenrod	63
2055	Bright Straw	56
2060	Medium Orange	51
2061	Orange	44
2070	Flame Red	27
2071	Primary Red	25

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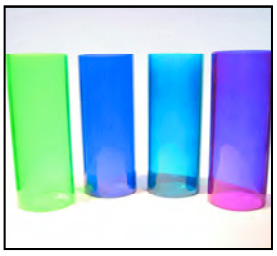
Type

TC

Cut sheet 7 of 8

FADE•NOT® POLYCARBONATE

PROJECT:	CONTACT:
FIXTURE/WATTAGE/BEAMSPREAD:	
LOCATION:	LENS SIZE:
ACCESSORIES:	COLOR:



Fade•Not® Polycarbonate is manufactured using only the best commercial grade polycarbonate. UV absorbers are added to the coloring process to prevent premature degradation, providing the longest life possible. **Fade•Not® Polycarbonate** can last years when used within standard operating temperatures. FX can coat a variety of plastic sheets and strips. All plastics are suitable for wet locations. Use **Fade•Not® Polycarbonate** on fluorescent fixtures, low temperature architectural or theatrical fixtures, inside fluorescent or low temperature bollards, and temporary outdoor applications such as holiday or theme lighting.

Substrates
We can coat yours or ours.

Plastic-Sheets
Our stock includes 2mil, 5 mil, 20mil and 30mil Sheets.
We can also get .0625 thick and up. Call for more sizes.

Color Selection
Any color or combination of colors from any theatrical color media can be specified. To aid in color decision making Special FX recommends mocking up with color. Once color is determined, FX can supply your project with product samples at little or no cost. We can also match provided color samples.

Specifying Fade•Not® Polycarbonate for your project
All FX products are custom manufactured for the specified lighting instrument. Contact Special FX Lighting by phone, fax, or email with project specifications, fixture information and color, which will be reviewed to recommend the longest lasting, most cost-effective product for your application.

Order Lead-time
Standard order lead-time for in-stock sheets is two weeks from receipt of Purchase Order.
Lead-time for non-stock sheets is approximately four weeks from receipt of Purchase Order.

SPECIAL FX® LIGHTING

435.635.0239 - VOICE 435.635.3929 - FAX INFO@FXLIGHT.COM - EMAIL WWW.FXLIGHT.COM - WEBSITE
293 N. 2260 W. PO BOX 177 HURRICANE UT 84737

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Cut sheet 8 of 8

DOUG FLEENOR DESIGN

Low Power, 12 Channel, ELV DMX512 Dimmer

model: DMX12DIM ELV
technical data sheet

The DMX12DIM ELV is a twelve output dimmer designed for high efficacy loads, and minimal losses. This dimmer uses “reverse phase” (aka: “trailing edge”) dimming techniques and MOSFET power devices. This type of control is required for proper dimming of many LED fixtures. Each output can drive loads up to 100 Watts. Each channel may be configured for reverse phase dimming (default), forward phase dimming, or non-dim operation.

The dimmer is a single-space rack mount unit with removable rack ears (included). Airflow is front to side. Half inch holes are provided for half couplers or C clamps. The enclosure features a carry handle and a 3/8 inch safety cable slot.

The unit is ETL Listed to the UL508 standard.

If you would like assistance in your application, please give us a call. We like to talk with our customers.

SPECIFICATIONS:	All specifications meet or exceed DMX512 requirements.
Input circuit:	Protected EIA-485 receiver (LT1785)
Input protection:	Undamaged by up to 60 Volts continuous, 15KV transients
Input signal:	0.2 volts minimum, DMX512, DMX512/1990, or DMX512-A
Input connector:	Gold plated 5 pin male XLR (Neutrik D-1 series) 3 pin XLR optional
Input pass through:	Gold plated 5 pin female XLR (Neutrik D-1 series) with all five pins passed through
Termination:	None, unused pass through connectors must be externally terminated
Power input:	120 VAC 60 Hz 10 Amps at full load, actual current draw is 0.07A plus connected load
Power input connector:	NEMA 5-15P (15A grounded parallel blade) on 18 inch 12 gauge pigtail
Idle power:	7 Watts
Power output:	120 VAC 60 Hz 0.83 Amps (100W) maximum per output
Minimum load:	No minimum load requirement
Output protection:	1.5A internal fuse on each output channel
Output connectors:	NEMA 5-15R (15A grounded parallel blade)
Dimming circuit:	Digitally fired, optically-isolated, MOSFET power devices that allow for forward or reverse phase dimmer control

Doug Fleenor Design, Inc.
396 Corbett Canyon Road
Arroyo Grande, CA 93420
(805) 481-9599 voice and FAX
(888) 4-DMX512 toll free (888) 436-9512
web site: http://www.dfd.com
e-mail: info@dfd.com

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Construction Document

Type

ELV Dimmer - DMX

Cut sheet 1 of 2

SPECIFICATIONS:	(Continued)
Rise/fall time:	2 uS (10% to 90% at 90 degree firing angle) at rated load
Dimming curve:	Square law, visually appealing on LED lamps (120V), halogen lamps, magnetic low-voltage (MLV) and electronic low-voltage (ELV)
Non-dim curve:	Each channel can be configured as a non-dim which turns on at 60%, off at 40% Outputs switch on at zero crossing. Other non-dim trip point options include 50% and 1% (globally settable).
DMX footprint:	Twelve consecutive DMX slots beginning with the selected DMX starting address
DMX starting address:	Three digit front panel thumbwheel switch, address changes are immediate (no power cycling required)
Local control:	An “address switch” setting of 601 turns on output 1, 602 turns on output 2, etc. A setting of 699 turns on all outputs. A setting of 698 turns on all outputs when DMX is present. A setting of 697 turns on all outputs if any DMX level is above zero.
Status indicators:	Red POWER indicator Green MIMIC 1 indicator mimics the intensity of output 1 (useful in troubleshooting) Green SIGNAL indicator illuminates when DMX512 is present and flashes when local control is active (address switch settings of 601 thru 612 and 697 thru 699)
Cooling:	Processor controlled low speed fan exchanges internal air from front to side.
Isolation:	DMX512 input is optically isolated from AC power circuits to 600 Volts.
Color:	Silver hammer tone with black front and rear panels.
Safety listing:	ETL Listed to UL 508
Size and weight:	1.7"H × 10.5"D × 19"W (17" behind rack ears), 7 pounds, rack ears are included.

Limited Manufacturer's Warranty

Products manufactured by Doug Fleenor Design (DFD) carry a five-year parts and labor warranty against manufacturing defects. It is the customer's responsibility to return the product to DFD at the customer's expense. If covered under warranty, DFD will repair the unit and pay for return ground shipping. If a trip is necessary to the customer's site to solve a problem, the expenses of the trip must be paid by the customer.

This warranty covers manufacturing defects. It does not cover damage due to abuse, misuse, negligence, accident, alteration, or repair by other than by Doug Fleenor Design.

Most non-warranty repairs are made for a fixed $50.00 fee, plus shipping

Doug Fleenor Design, Inc.
396 Corbett Canyon Road
Arroyo Grande, CA 93420
(805) 481-9599 voice and FAX
(888) 4-DMX512 toll free (888) 436-9512
web site: http://www.dfd.com
e-mail: info@dfd.com

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Type

ELV Dimmer - DMX

Cut sheet 2 of 2

ColorSource Consoles

ColorSource System

GENERAL INFORMATION

Available in two sizes with optional audiovisual and ethernet capabilities, ColorSource consoles provide hands-on control designed for the latest technology. These affordable, portable desks specialize in streamlined, plug-and-play setup; the console recognizes intelligent lights in the rig via RDM and auto-populates them in patch, and the on-board touchscreen allows fixtures to be dragged into place on a customizable stage map for quick selection and programming. The faders and touchscreen can be used to control moving lights, mix LED colors, play stored looks and effects and - with the AV consoles -play sound and visual media.

APPLICATIONS

- One-off events
- Corporate theaters
- Touring productions
- School auditoriums/theaters
- Community theaters
- Houses of worship
- Small TV studios
- Tradeshows

ORDERING INFORMATION

ColorSource consoles

MODEL	PART NUMBER	DESCRIPTION
CS20	7225A1000-US	20 Fader ColorSource console (80 Channels or Devices)
CS40	7225A1001-US	40 Fader ColorSource console (80 Channels or Devices)
CS20AV	7225A1100-US	20 Fader ColorSource AV console with network, audio, and video features (80 Channels/Devices)
CS40AV	7225A1101-US	40 ColorSource AV console with network, audio, and video features (80 Channels or Devices)

ColorSource Accessories

MODEL	PART NUMBER	DESCRIPTION
CS20DC	7225A4020	Dust cover CS20 and CS20AV
CS40DC	7225A4021	Dust cover CS40 and CS40AV
CS20RK	7225K1002	19" Rack mount kit for CS20 and CS20AV consoles
	I1865	Pelican Case with foam for CS20 and CS20AV consoles
	I1866	Pelican Case with foam for CS40 and CS40AV consoles
	7225A2020-US	Replacement Power supply (Edison connector)

SHIPS WITH:

- Power supply

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Type

Lighting Control Board

Cut sheet 1 of 4

Available Light • 919.364.6464 x127
5700 Six Forks Road, Suite 203 • Raleigh NC 27609

SPECIFICATIONS

MECHANICAL
- One home and five configurable softkey buttons
- Four configurable function faders
- 7" color multi-touch touchscreen

PLAYBACK CONTROLS
- One cue list with 999 cues
- 10 pages of 20 or 40 playbacks
  - Static memories or sequences
- Playback Toy for filtered and timed execution of playbacks
- Mulitple bump modes (Flash, Solo, Solo Change, Move/Go)
- Full-history rubberbanding for playbacks
- On-board help system
- Extensive library for controlling moving lights

MEDIA
- Audio input type:
  - 3.5 mm (1/8") TRS, Stereo, unbalanced
  - Line in -10 dBV (316 mV RMS)
  - Input Impedance: 29k ohms
- Audio output type:
  - 3.5 mm (1/8") TRS, Stereo, unbalanced
  - Line out -10 dBV (316 mV RMS) at 10k ohms "Line Level"
  - Load Impedance : 10k – 200k ohms
- Supported media file formats:
  - Audio: mp3, aac and wav files (44.1 kHz sample rate, 4 GB maximum file size)
  - Image: jpg, png, tiff, and bmp files (1280 x 720 maximum resolution)

    Please note: visual output is limited to still images and effects from the VideoToy feature of the ColorSource AV console. Movie files are not supported

REGULATORY AND COMPLIANCE
- cETLus Listed
- CE Compliant

SPECIFICATIONS

PROGRAMMING TOOLS
- Color and white pickers
- Reference based Position, Color and Beam palettes
- Innovative touch-based parameter controls
- Auto fixture selection on fader moves
- Virtual Level/Rate wheel
- Cutomizable Channel display using Stage Map
- Effects (intensity, color, shape, and parameter)
- Fixture Tags for Quick Selects
- 27 Quick Select groupings
- Two independent channels
- Virtual keypad for level entry

UNIQUE FEATURES
- **COLORSOURCE 20**
  - 80 channels / multi-parameter devices
  - 20 Channel / Playback faders with color indication
  - One DMX/RDM port
  - One USB port
  - 2 GB onboard storage for show files
- **COLORSOURCE 40**
  - 80 channels / multi-parameter devices
  - 40 Channel / Playback faders with color indication
  - One DMX/RDM port
  - One USB port
  - 2 GB onboard storage for show files
- **COLORSOURCE 20 AV**
  - 80 channels / multi-parameter devices
  - 20 Channel / Playback faders with color indication
  - Two DMX/RDM ports
  - Two USB ports
  - RJ45 for network (sACN, ArtNet, OSC)
  - Sound-to-light playback
  - HDMI® port for monitor or media playback
  - "Amigo" browser-based remote
  - 25 GB onboard storage for show files and media
- **COLORSOURCE 40 AV**
  - 80 channels / multi-parameter devices
  - 40 Channel / Playback faders with color indication
  - Two DMX/RDM ports
  - Two USB ports
  - RJ45 for network (sACN, ArtNet, OSC)
  - Sound-to-light playback
  - HDMI port for monitor or media playback
  - "Amigo" browser-based remote
  - 25 GB onboard storage for show files and media

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Construction Document

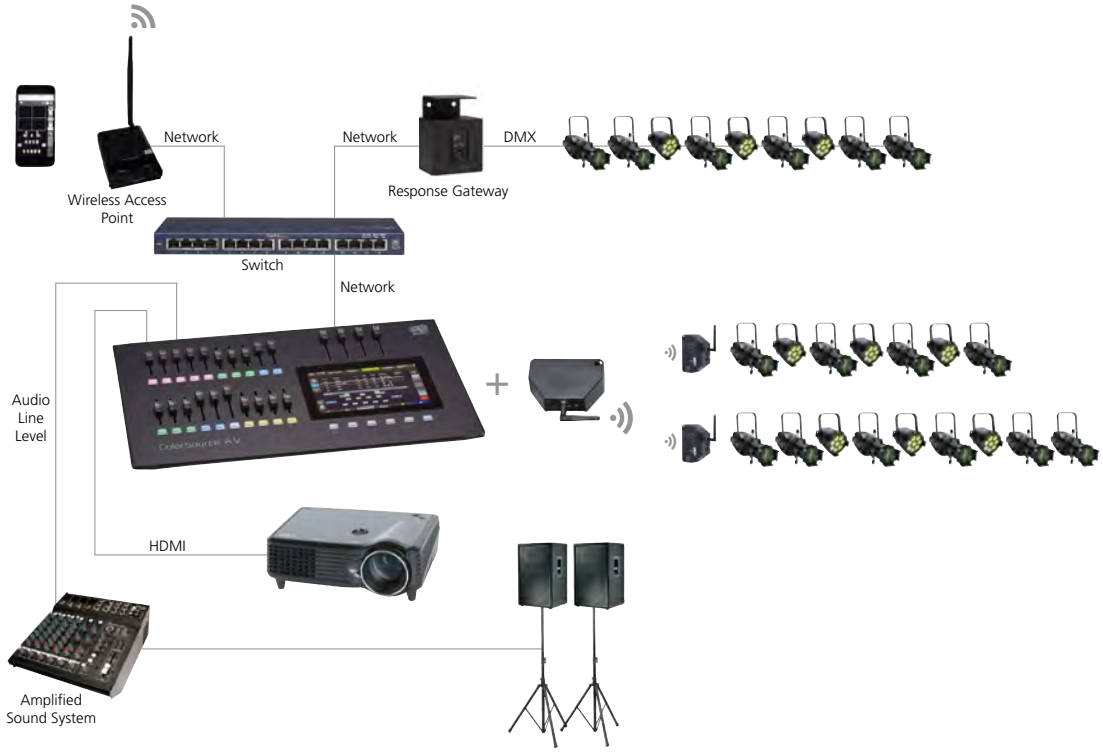
Type

Lighting Control Board

Cut sheet 2 of 4

COLORSOURCE CONSOLE SAMPLE SYSTEM

COLORSOURCE AV SAMPLE SYSTEM



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Type

Lighting Control Board

Cut sheet 3 of 4

PHYSICAL

ColorSource Console dimensions*

MODEL	HEIGHT		WIDTH		DEPTH	
	in	mm	in	mm	in	mm
CS20 / CS20AV	2.36	60	18.3	465	11	279
CS40 / CS40AV	2.36	60	26.3	668	11	279

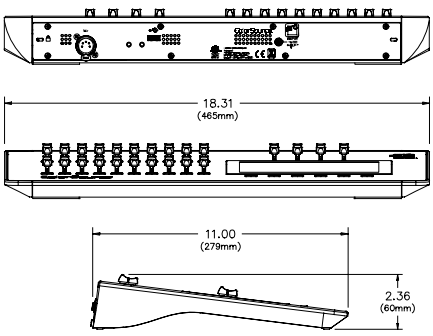
*Weights and dimensions typical.

ColorSource Console weights*

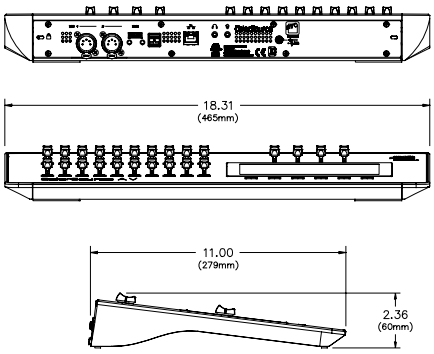
MODEL	WEIGHT		SHIPPING WEIGHT	
	lb	kg	lb	kg
CS20 / CS20AV	6.9	3.13	10.85	4.92
CS40 / CS40AV	9.55	4.33	13.55	6.15

*Weights and dimensions typical.

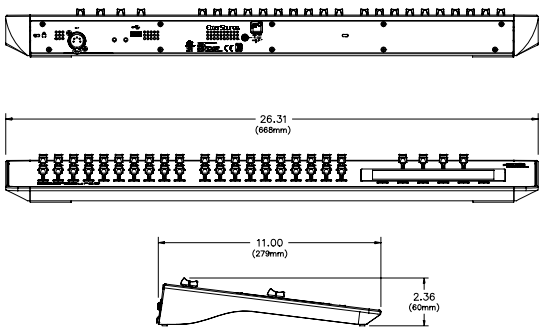
COLORSOURCE 20



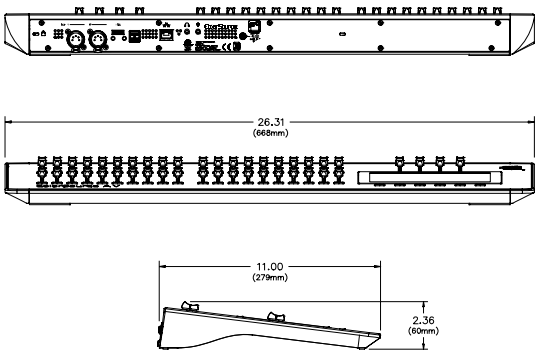
COLORSOURCE 20 AV



COLORSOURCE 40



COLORSOURCE 40 AV



Corporate Headquarters • Middleton, WI USA
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Stow Town Hall

Construction Document

Type

Lighting Control Board

Cut sheet 4 of 4

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Stow Town Hall

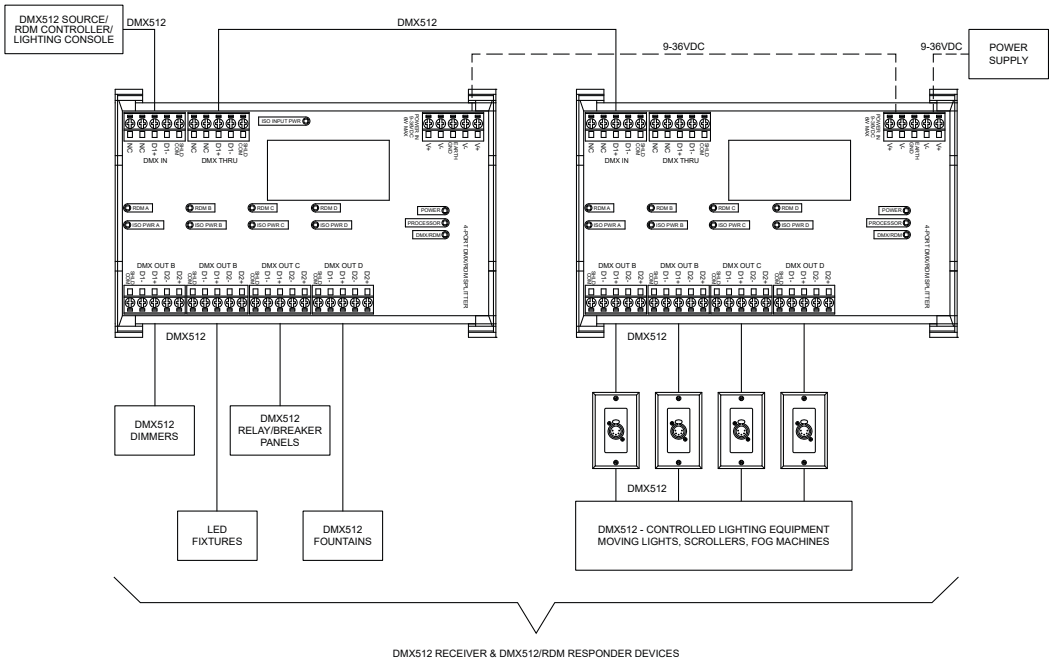
Construction Document

Type

Opto-Splitter

Cut sheet 1 of 3

APPLICATION EXAMPLE



DMX PIN OUTS

DMX512/RDM PINOUT: FOR SHIELDED TWISTED PAIR

XLR PIN #	PURPOSE
1	Shield
2	Data - (complement)
3	Data + (true)
4	N/C - No Connection
5	N/C - No Connection

DMX512/RDM PINOUT: FOR CAT 5/6

XLR PIN #	CAT5/6 Pin # and Color	PURPOSE
3	1 - White/Orange	Data 1 + (true)
2	2 - Orange	Data 1 - (complement)
5	3 - White/Green	N/C - No Connection
4	6 - Green	N/C - No Connection
-	4 - Blue	N/C - No Connection
-	5 - White/Blue	N/C - No Connection
1	7 - White/Brown	Shield/COM
1	8 - Brown	Shield/COM

*Note: The product silkscreen may show D2+ and D2- on DMX Ports (pins 4 and 5). These pins are included as a convenience for landing multi-conductor cable but are not electrically connected and serve no purpose beyond safe termination of wiring. Pins 4 and 5 are **not an additional DMX port**. Newer products have changed this marking to "NC" for No Connection.*

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Stow Town Hall

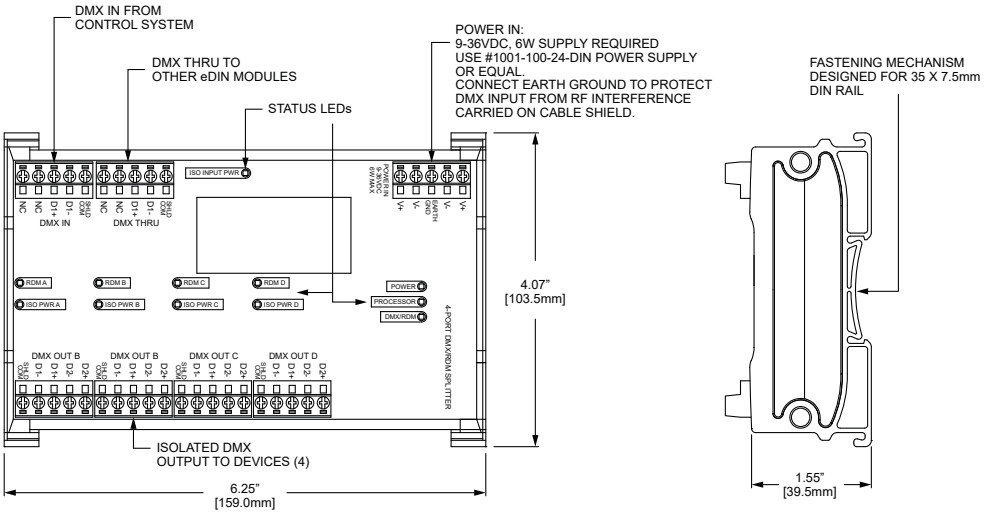
Construction Document

Type

Opto-Splitter

Cut sheet 2 of 3

DIMENSIONS AND CONNECTIONS



ORDERING INFORMATION

PART #	DESCRIPTION
1009	DMX/RDM Repeater, 4-Way, eDIN, Fully Isolated (6.25")
ACCESSORIES	
1001-050-24-DIN	50 Watt, 24VDC Power Supply, DIN-Mountable
1001-100-24-DIN	100 Watt, 24VDC Power Supply, DIN-Mountable
1103	eDIN Rack Mount Panel, 2RU high, two 16.5" DIN Rail
1105	eDIN System Enclosure 10" x 13" x 4.5" c/w One 9" Vertical DIN Rail
1106	eDIN System Enclosure 10" x 23" x 4.5" c/w One 19" Vertical DIN Rail
1107	eDIN System Enclosure 10" x 23" x 4.5" c/w Three 9" Horizontal DIN Rail
1108	eDIN System Enclosure 10" x 13" x 4.5" c/w Two 9" Horizontal DIN Rail
1109	Expanded eDIN System Enclosure 18.5" x 31.5" x 6.5" c/w Three 24" Vertical DIN Rail, One 18" DIN Rail in Class 1 section, two 3-gang knockouts in removable door

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Stow Town Hall

Construction Document

Type

Opto-Splitter

Cut sheet 3 of 3

SECTION 27 41 00 – AUDIOVISUAL SYSTEMS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Attention is directed to Division 00 and Division 01, as listed in the Table of Contents, which are hereby made part of this Section by reference thereto.
B. Attention is directed to the existing conditions at the site. The Contractor shall become thoroughly familiar with the existing conditions in order to assess the scope of work required.

1.02 DESCRIPTION OF WORK

A. The work of this Section consists of the provision of all materials, labor, and equipment and the like necessary and/or required for the complete execution of all audiovisual equipment and related work for this project as required by the schedules, keynotes and drawings, including, but not limited to the following:

1. Unless otherwise specified, supply only new equipment, parts and material, and protect all equipment from construction dust and debris until final acceptance. Operate only as required for testing as part of installation procedure. Provision of all manufactured components, installation, wiring, and testing is the responsibility of a single contractor.
2. The system drawings indicate the general layout of the various items of equipment and their functional relationships. However, layout of equipment, accessories, and conduit systems are diagrammatic unless specifically detailed and do not necessarily indicate every item required for a complete installation. Provide any incidental equipment needed in order to result in a complete and operable system even if not specified or shown on drawings without claim for additional payment.
3. Quantities of all major installed and all portable equipment, including any add- or deduct- alternates, are indicated on the system and electrical drawings. Quantities of portable equipment are indicated in schedules contained in the drawings or specifications; quantities of installed equipment are determined by examining the functional diagrams, plans, and riser diagrams.
4. Refer to audiovisual conduit drawings for receptacle backbox location and quantity information. Also refer to architectural reflected ceiling plans for exact location of ceiling-mounted devices.
5. Verify correctness of parts lists and equipment model numbers and conformance of each component with manufacturer's specifications.
6. Obtain all permits necessary for the execution of the work. Comply with all applicable local codes and regulations.
7. Provide inserts; cover plates, etc. as required for a complete system.
8. Supply and install miscellaneous steel and mounting hardware, such as Unistrut, above finished ceiling for mounting video projector unless otherwise noted.

B. Functional Requirements of Systems:

1. Audiovisual contractor shall coordinate installation work with the Project's General and Electrical contractors.
2. AV systems shall be capable of all functionality as described within this specification and on the audiovisual system drawings. Functions listed below are listed for reference and will be the basic minimum requirements.

   a. <u>Great Hall</u>

1) The Great Hall will be used for public hearings, town entertainment, panel discussions, lectures, group meetings, and unamplified and amplified musical performances. The audiovisual system will comprise the following:
2) Sound System
   a) Microphones:
      (1) Wired Microphones: The system will include connections for up to twelve (12) wired microphones that are installed within three floor-boxes on the stage (four microphone inputs per floor-box). One (1) gooseneck microphone will be provided for connection to a lectern (lectern, by others). A stereo microphone will be hung in the room and used for simple audio recordings. Additionally, four ceiling-mounted microphones will be provided; two will be hung over the stage, and another two will be hung over the audience area. The audio from these ceiling microphones will be sent to a receptacle panel in the back of the room for use by the local broadcaster. Finally, connections for wired microphones will be available along the side and rear walls of the seating area.
      (2) Wireless Microphones: The system will include a four (4) wireless microphones. It will include a 4-channel wireless microphone receiver (rack-mounted), four (4) lavalier ("clip-on") microphones and belt-pack transmitters, and four (4) handheld microphone transmitters. The four handheld microphone transmitters will interchangeable with four of the lavalier systems.
   b) Audio Mixing: The system will operate in an automatic mode. This will allow an end-user to connect a microphone to the system at one of multiple designated microphone receptacle locations (or use the wireless microphones). Master volume control will be accessible from the AV system control panels. A technician will not be required to operate the sound system.
   c) For events when more complex operation of the sound system is required, audio tie-lines will be provided between the floor boxes at the stage and a receptacle panel at the rear of the Great Hall (mix position). This will be used with portable Owner-furnished or rental audio equipment (mixing console, powered loudspeakers, etc.) and will allow the operator to connect the equipment without needing to run cables across the floor of the Great Hall.
   d) Audio Recorder: An SD/USB recorder will be installed in the AV equipment rack and will be used for recording events from the stereo microphone. A USB connection will allow recordings to be transferred to a thumb-drive, or onto a computer on the local IT network. Controls for the audio recorder will be available from the AV system control panels. From the control panel, the user shall be able to select between the default ceiling-mounted stereo microphone (for non-amplified events), or a sub-mix of all audio being fed through the local sound system.
   e) Audio Signal Processing: A digital audio signal processor will be used for automatic microphone mixing (as described above in paragraph 1.b.), and equalizing the loudspeakers. The signal processor will be expandable so that, if required, additional input and output capacity can be added to the system in the future.
   f) The system will include audio connectivity for use by the local broadcaster. This will include separate audio outputs for a mono mixed microphone audio feed, a stereo program audio feed, a feed from the ceiling-microphone above the stage, and a feed from the

ceiling-microphone above the audience area. These audio outputs will be available on a wall-mounted receptacle panel at the broadcast operator position.

g) Loudspeakers: Loudspeakers will be provided for speech reinforcement and program audio playback. These will consist of two self-powered digitally-steerable column loudspeakers that will be wall-mounted on the left and right sides of the stage. A subwoofer will be provided for low frequency enhancement. The loudspeaker system will provide uniform audio coverage through the audience area allowing the system to provide high levels of speech intelligibility and musical clarity.

h) Amplifier: An amplifier will be used to power the subwoofer loudspeaker.

i) Assistive Listening System: An FM-based wireless assistive listening system will be included to meet the requirements of the Americans with Disabilities Act. Portable receivers (i.e., headphones) will be stored centrally and issued to participants as required. These receivers are intended to be used by patrons with hearing impairments.

3) Display System

a) Video Projector: The system will display computer and motion video using a single-chip 10,500 ANSI lumen high-definition video projector (4K resolution). The projector will be located within millwork at the front edge of the balcony.

b) Projection Screen: The projection screen will be motorized and will be ceiling-mounted at the upstage wall. The screen will include tab-tensioning (a feature used to keep the image area flat) and black borders around the image area to better define the edges of the image.

c) AV Sources: AV sources will include a Blu-ray player, a wireless AV presentation gateway (used for displaying content of network-connected sources, such as a laptop, smart phone, or tablet, to the AV system via the building's Wi-Fi network), a Bluetooth enabled audio input receptacle, and an Owner-furnished computer. HDMI inputs for portable AV devices, such as a laptop computer, will be available within two of the three floor-boxes (stage right, and stage center).

d) Video Routing: Network-based AV transceivers will be used to route video and associated audio within the system. The system will support playback and distribution of digital video formats and the transport system will be compatible with newer generation 4K sources. One (1) portable transceiver will be provided to allow for connecting a portable AV source device (such as a laptop computer) to the AV system from a position away from the stage.

e) The system will include video connectivity for use by the local broadcaster. This will include a program video output (HDMI) so that video content being displayed by the video projection system can be fed directly to the broadcaster's equipment. Additionally, cabling will be provided to support camera tie-lines (that supports HD-SDI camera signals) between wall-mounted receptacle panels in the Great Hall to the broadcast operator position.

4) System Control

a) The control system will be used to simplify the operation of the audiovisual system by unifying the operation under one platform and user interface. The user interfaces will consist of one (1) wall-

mounted 7” LCD touch screen control panel mounted at the stage wall, and one (1) wall-mounted 7” LCD touch screen control panel mounted at the rear of the Great Hall.

b) The control panels will be able to control all functions of the audiovisual system; including powering on/off the system, the projection screen (up/down/stop), source selection and media transport controls, and can interface with other operational functions including lighting (note that lighting presets will be in the scope of the lighting installer, and that coordination between the AV contractor and lighting system installer during installation will allow for some lighting system presets to be selectable via the AV control system).

c) This category also includes a Power-over-Ethernet (PoE) data switch that will be used by the AV control system for communication between AV devices, the video system for signal transport and distribution, and the audio system for Dante digital audio signal transport and distribution. AV data switches will connect to the building’s data network for communication with the outside world, but the AV network will be independent and AV signals will not traverse outside of this network.

5) Miscellaneous

a) Miscellaneous equipment includes a floor-standing and lockable equipment rack, AC power distribution and sequencers in the rack, a UPS, custom connection panels, and all cable, connectors, and additional hardware and labeling required to install the system.

C. Related Work Specified Elsewhere:

1. Miscellaneous Metals (05 50 00).
2. Rough Carpentry (06 10 00).
3. Finish Carpentry (06 20 23).
4. Caulking and Sealing (07 92 00).
5. Glazing (08 80 00).
6. Gypsum Board Assemblies (09 21 16).
7. Electrical (26 00 00)

D. Definitions:

1. Owner: Town of Stow.
2. Consultant: Acentech Incorporated.
3. Bidder: Audiovisual contractor or other entity generating the response to this set of audiovisual bid documents.
4. Audiovisual Contractor or Contractor: Company responsible for work under this section.
5. Furnish: procure, and deliver the equipment to the job site, freight prepaid, for receipt, staging, and installation by others.
6. Install: Provide, store, unpack, and securely attach or mount equipment to structure following industry standards, approved shop drawings, and manufacturer recommendations.
7. Provide: Furnish and Install equipment.
8. Provided by Others and Not in Contract (NIC): Work related to this contract, but will be provided by parties other than the AV Contractor.
9. Owner-Furnished Contractor Installed (OFCI) or Owner-Furnished Equipment (OFE): Equipment furnished by the Owner for installation by the Audiovisual contractor. The Audiovisual contractor shall be responsible for installing and integrating this equipment as detailed herein.
10. Installation Materials: Installed cable, loose cable, terminations, cable management, voice/data/video patch cords, adapters, I/O panels, cable dressing,

lacing bars, copper bus bars, labels, rack shelves, rack mounts, power strips/distribution, and other materials as needed to install the systems.

11. Audio:

    a. XLR Connectors and Receptacles: Connectors and receptacles conforming to proposed E.I.A. Standard RS-297-B referred to as "XLR"-type connectors and receptacles.
    b. Units and Symbols: Metric units according to the System of International Units (SI) are used as well as other common units and symbols.
    c. Octave and 1/3-Octave Bands: Centered on ANSI preferred frequencies.
    d. Sound Level Meter and Filter Set: Calibrated ANSI Type 1 meter with ANSI S1.11-1966 1/3 octave band filters.
    e. Pink Noise: Constant energy in constant percentage bands, random or quasi-random noise.
    f. Loudspeaker Power Rating: Based on pink noise test signal with 6 dB peak-to-average ratio, bandwidth as stated.
    g. Loudspeaker Coverage Pattern: Nominal angular coverage included at -6 dB points relative to axial response, bandwidth as stated.
    h. DI: Axial directivity index.
    i. Loudspeaker Sensitivity: Axial level in dB with 1 watt input at 1 meter distance.
    j. Microphone Sensitivity: Level in dB re 1 milliwatt into rated impedance at 1000 Hz (or as otherwise stated) and 94 dB SPL. (10 dynes/cm^2 or 1 Pa).
    k. SPL: Sound pressure level in dB re 0.00002 Pa (0.0002 microbar).
    l. Power Amplifier Output Power Rating: Based on continuous average sine wave test signal. Load impedance and bandwidth as indicated.
    m. Amplifiers and Signal Processors: Frequency Response, Distortion, and Hum and Noise re full rated output level.

E. Equipment Furnished by Audiovisual Contractor and Installed By Others:

    1. Provide device boxes/conduit boxes to the Electrical Contractor for installation as indicated on AV Contract Drawings or required.

1.03 SUBMITTAL REQUIREMENTS

A. General:

    1. Contractor must provide four submissions as described in this specification. Those submissions include:
    2. Bid submission
    3. Shop drawing, bill of materials, and programming
    4. Test reports
    5. As-Built drawings and operation manuals

B. In keeping with the practices of LEED™, submittals shall be delivered in electronic format as Excel *.xls or *.xlsx, AutoCAD *.dwg (with bound XREFs), Revit *.rvt (with imported files), Word *.doc or *.docx, or combined PDF files via FTP posting, DVD, USB flash drive, or e-mail.

C. Delivery Schedule:

    1. Bid submittal package: By date specified, to include:

        a. Basis of bid documents, including:

            1) Itemized equipment costs for specified equipment or APPROVED substitutions.
            2) Qualifications/References
            3) Certifications (including certificate of bonding, if required)
            4) Proposed payment terms

b. Bill of material submission: No later than 30 days following award of contract provide the following as one unified package:

   1) Bill of materials
   2) Manufacturer product data sheets

c. Shop drawing submission: No later than ## days following award of contract provide the following as one unified package:

   1) Shop drawings.
   2) Control system layouts and digital signal processing configurations.

d. Test result submission: One week before acceptance testing provide the following:

   1) System test and certification reports
   2) Owner's manuals with manufacturers' equipment manuals
   3) One (1) draft copy of user operational manuals
   4) One (1) draft copy of "as-built" system diagrams

e. As-built drawings and operational manual submission: Within 30 days after final acceptance testing visit provide the following:

   1) Final as-built system diagrams in hard copy and editable electronic file formats.
   2) Final user operational manuals in hard copy and editable electronic file formats.
   3) Control software for AV Control System, digital signal processors, and other programmable devices. Include complete job-specific source code files.
   4) Custom finish material samples, if applicable.

f. Unless otherwise directed by contract, do not order equipment until the bill of materials has been reviewed and approved by the AV consultant.
g. Approval for isolated items will not be considered, except by prior AV consultant authorization.
h. Rejected items and items requiring correction must be resubmitted together, unless authorized otherwise.

1.04 BID SUBMITTALS

A. Instructions to Bidders: To be considered, Bids must be made in accord with the Architect's Instructions to Bidders and this Article.
B. Examinations: Carefully examine the contract documents and the construction site to obtain first-hand knowledge of existing conditions. Contractors will not be given extra payments for conditions that can be determined by examining documents on-site, and will not be relieved of any obligations with respect to bid.
C. Equipment for the project is shown on the plans, reflected ceiling plans, elevations, and functional diagrams. The contractor must develop a list of equipment for each type of space detailed on the drawings. Contractor is responsible for providing miscellaneous parts to provide a complete and working audiovisual system in each of the spaces outlined in the drawings.
D. The system was designed around the Crestron control system. AMX or Extron is an acceptable substitute. The contractor will be responsible for providing the equipment necessary to provide a complete system if AMX or Extron is provided.
E. Questions: Submit questions about the contract documents in writing. Replies requiring changes to the contract documents will be issued to bidders as addenda and will become part of the Contract. The Architect and Owner may give, but will not be responsible for oral clarifications. Questions received less than 10 days before bid date cannot be answered in writing.

F. Acceptable Products: Model numbers and manufacturers identified herein indicate a standard of quality and performance. Other products will be considered, subject to approval of complete technical data, samples and results of independent testing of proposed equipment, submitted in accordance with Division 1 requirements and "Substitutions" section below.
G. Substitutions: To obtain approval for substitutions and for items identified as "approved equal", submit written requests at least 10 days before bid date. Requests received after this time will not be considered. Requests shall clearly describe the product for which approval is asked, including data necessary to demonstrate acceptability. If the product is acceptable, an Addendum may be issued to bidders.
H. Equipment Availability: Verify with manufacturers availability and cost of equipment proposed, including equipment specified herein. No cost increases will be allowed for manufacturers' cost increases, or for substitutions required because of unavailability of proposed equipment.
I. Performance Bond: The successful bidder will furnish a Performance Payment Bond and Labor and Material Bond, underwritten by a surety company approved by the Architect and Owner, for fulfillment of provisions of the contract.
J. Basis of Bids:

1. Submissions will be provided in electronic format described below. Electronic submissions must be supplied in Microsoft Excel. *.xls or *.xlsx format.
2. Include a complete itemized list for each base-bid system indicating the manufacturer, model number, unit cost and total costs for specified items. Itemization of miscellaneous equipment such as cable, switches, and receptacles is not required.
3. Clearly indicate the total cost, including expenses, for each individual system to allow the Owner to select any or all systems to be included in the contract. Itemization of miscellaneous equipment such as cable, switches, and receptacles is not required.
4. Organize each list with the information presented, in the order that it appears in this specification, in 6 columns from left to right:

   a. Paragraph number as it appears in this specification.
   b. Paragraph title as it appears in this specification.
   c. Manufacturer and model number.
   d. Quantity.
   e. Unit Cost.
   f. Extension (unit cost times quantity).
   g. Example:

Paragraph #	Paragraph Title	Manufacturer & Model Number	Qty.	Unit Cost	Extended Cost
Section 2.1	Microphones				
2.1.B	Hand-Held Microphone	xxx	#	$$	$$$$

5. At the end of each list indicate the cost of other items, such as for miscellaneous equipment, engineering, installation labor, overhead, taxes, etc.
6. On a separate list, indicate costs of any specified add- or deduct-alternates with the information presented in the same manner as for the base-bid system.
7. Include a listing of any voluntary alternates proposed by the bidder as substitutions or additions to the specified systems.
8. Include any notes or comments if necessary to qualify the bid.
9. Identify any sub-contractors and indicate the work they are to do.
10. Provide documentation of ability in installing similar systems. Furnish the names, addresses, and telephone numbers of the System Designer, Architect, General Contractor, and Owner on three projects similar in scope, which the Contractor has installed within the last 5 years.

11. Include certification of ownership and full familiarity with the operation of the following minimum test equipment. Provide a list of the manufacturer, model, and serial number for each item of test equipment required.

    a. Audio Test Equipment:

        1) SMAART, EASERA or similar measurement platform that includes a laptop computer, audio preamp, Type 1 measurement microphone, cables, and stands, to complete the system test.
        2) AC impedance bridge.
        3) Sound level meter and octave band filter set.
        4) Digital Multimeter.
        5) Calibrator with appropriate microphone adapter similar to General Radio, Norsonic, or Rion calibrators.
        6) Random or pseudo-random pink noise generator.
        7) Plug and cable tester (suggested: Whirlwind DCT-9 or PylePro PCT40).
        8) Loudspeaker polarity indicator (suggested: BSS Audio AR130,).

    b. Video Test Equipment:

        1) Photometer with luminance and illuminance probes.
        2) TriStimulus Color Analyzer with Laptop computer (suggested: Sencor OTC1000-CM).
        3) HDMI (2.0) and HDCP (2.2) 18 GPS video generator. Murideo SIX -G
        4) 18 GBPS analyzer for resolution, data, EDID, and Infoframe, HDR Murideo SIX-A.
        5) 12G/6G/3G SDI test pattern generator. Output format SMPTE 292-M/259M/424-M/ST_2081/ST-2082. SIIG 4K X 2K 12-G SDI Video Generator.
        6) HDMI cable test instrument similar to the Quantum Data 780BH.
        7) Coaxial cable test kit (for testing whether in-place cable will support SDI signals): FM Systems CTG-500 kit.

K. QUALITY ASSURANCE

1. Project Management: Maintain the same person in charge of work throughout installation.
2. Contract Documents: Maintain a complete set of system drawings and specifications at the site during installation.
3. Fabrication and Installation: Completely fabricate equipment racks and subassemblies in contractor fabrication shop. Make field connections of audio, video, and control wiring including microphone, line level, loudspeaker, video, and control system circuits to equipment, equipment racks, and connection panels. Continuously supervise the installation and connection of cable and equipment.
4. Contractor Qualifications: To be considered qualified for this work; the contracting firm must be experienced in the provision of audiovisual systems similar in complexity to those required for this project, and meet the following:

    a. The Contractor's primary business is the provision, fabrication, and installation of professional audiovisual and related systems.
    b. The Contractor has been regularly engaged in the installation and service of professional audiovisual presentation systems for a period of at least five years.
    c. The Contractor is an authorized dealer for the specified Audiovisual Control System systems.
    d. The contractor employs a Certified programmer for programming Audiovisual Control System, as required.

e. The Contractor is, at a minimum, AVIXA certified solution provider, with at least (1) CTS-I and (1) CTS-D certified employee on-site for the duration of the installation.
f. The contractor has a Crestron/Extron/QSC/etc.Certified Installer onsite during the installation and termination of HDBaseT or similar digital transmission systems (DigitalMedia, NVX, XTP, DTP, etc.) equipment, as required.
g. At the request of the Architect, demonstrate the following capabilities:
    1) Adequate plans and equipment to complete the work.
    2) Sufficient staff with appropriate technical experience to oversee and execute the work.
h. Subcontractors: The Contractor may arrange for sub-contract field and special shop work to be done by others.

1.05 SUBSTITUTIONS

A. General: The Contractor has the burden of proving, at the Contractor's own cost and expense and to the satisfaction of the Architect, that the proposed product is similar and equal to the named product.
B. Basis:
    1. Requests for acceptance of proposed equivalents made following the award of bid will be considered by the Architect only in the following cases:
        a. The named products cannot be obtained by the Contractor because of strikes, lockouts, bankruptcies or discontinuance of manufacturer and the Contractor makes a written request to the Architect for consideration of the proposed equivalent.
        b. The proposed equivalent, in the opinion of the Architect, is equal or superior to the named product and its use is to the advantage of the Owner.
C. A formal request must be made for the substitution documenting fully the above reason. Include complete data on the proposed substitution substantiating compliance with the Contract Documents including: product identification and description, performance and test data, references and samples where applicable, and an itemized comparison of the proposed substitution with the products specified or named by Addenda, with data relating to Contract time schedule, design and artistic effect where applicable, and its relationship to separate contracts. Accompany the request by accurate installed cost data on the proposed substitution in comparison with the product specified.
D. Consideration:
    1. A request for substitution is a representation by the Contractor that:
        a. The Contractor has personally investigated the proposed substitution and determined that it is equal or superior to that specified.
        b. The Contractor will provide the same warranty for the substitution that would be for that specified.
        c. The cost data presented are complete and include related costs under this Contract, but exclude costs under separate contracts and exclude Architect's re-design costs, and that the Contractor waives claims for additional costs related to the substitution, which subsequently become apparent.
        d. Indicate if there will be any cost impact on work by other trades.
        e. The Contractor will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete.

E. Change Order modifying the Specifications will document an accepted substitution. The Contract Price will be changed only if the substitution results in cost savings to the Owner.

1.06 SHOP DRAWING AND BILL OF MATERIAL SUBMITTALS

A. Coordinate submittals with requirements set forth in Section 00 10 00 Solicitation.
B. CAD drawings will be in current AutoCAD .dwg format (with bound XREFs) or portable document format (PDF). Other submissions will be provided as PDFs, unless otherwise stated.
C. Shop Drawings and Bill of Materials Submittals:

1. General:

a. The following is required for approval, prior to ordering product, fabrication, and installation. Submit complete and at one time. Isolated items will not be considered for approval, except by prior authorization. Rejected items and items requiring correction must be resubmitted at one time, except by prior authorization.
b. Submittals shall be provided as complete electronic PDF files that include the following:

1) A single collated file of the Bill of Materials for each system, listed in the order it appears in this specification, configured to print on standard 8-1/2" x 11" or 11" x 17" paper.
2) A single collated file of cut sheets for equipment listed in this specification configured to print on standard 8-1/2" x 11" paper.
3) A single collated file containing drawings configured to print as a full-size set at project standard sheet size.
4) Control system touch panel layouts, as identified below.
5) Digital signal processing layouts, as identified below.

c. The diagrams and details included with these specifications, modified to reflect the stated requirements and to reflect the details of the system as awarded, and including additional required information, may be used in preparing shop drawings. Drawings that are submitted without the necessary modifications will be rejected.

2. Bill of Materials and Catalog Data Sheets:

a. Bill of Materials and Catalog Data Sheets of manufactured items. At the end of the Bill of Materials include Catalog Data Sheets ("cut" sheets) for product arranged in the order listed in the specifications and in the Bill of Materials. Include a cover page identifying the project and submittal. Organize the Bill of Materials in 6 columns from left to right.

1) Paragraph title as it appears in this specification.
2) Manufacturer.
3) Model number.
4) Quantity.
5) Comments (if any are needed).
6) Example:

Paragraph #	Paragraph Title	Manufacturer	Model No.	Qty.	Comments
Section 2.1	Microphones				
2.1.B	Hand-Held Mic	xxx	xxx	#	

3. Shop Drawings:

a. Block diagrams: Provide block diagrams of proposed connections of equipment that indicate equipment types and model numbers.

b. Room Layouts: Equipment/projection/control room/studios layout(s), and equipment rack and cabinet details.
c. Video Projectors: Provide plan and section drawings verifying image width, lens-to-screen distances and mounting methods. Provide detailed drawings of custom-fabricated or stock mounts and hardware, as well as locations of auxiliary electronic devices, such as digital media receivers.
d. Projection Screens: Provide elevation drawing for each projection screen showing floor, ceiling, and screen, with screen size and dimensions for extra drop and image height above the floor indicated.
e. Antenna, Monitors, and Control Panels: Provide drawings in plans and section the detail mount arrangements and orientation for antenna and control panels.
f. Loudspeakers: Provide drawings showing arrangement of arrayed loudspeaker components, showing physical arrangement and orientation as well as structural support and any nearby architectural components affecting the coverage provided by the arrayed loudspeakers. Provide drawings stamped by a certified structural engineer indicating review and approval of indicated structural supports.
g. Others as required by Architect or Consultant.

4. Audiovisual Control System and Digital Signal Processing:

a. Detailed control panel layouts and control logic notes, prepared by the control system programmer:
b. Provide tree diagrams indicating signal flow for review and approval by Owner and AV Consultant.
c. Upon approval of the above by AV Consultant, and prior to beginning control system code development, provide color draft set of control system touch panel layout diagrams (Graphic User Interface) for review and approval by Owner and AV consultant, noting comments from prior review. Include text, buttons, colors, images, and backgrounds as well as page flips, sub-pages, and overall page logic flow.
d. Upon approval of the above by AV Consultant, provide control system touch panel programming file for final review and approval by Owner and AV consultant, noting comments from prior review.
e. Detailed layouts for digital signal processors:

1) Signal flow diagrams.
2) Detail presets and interconnection to audiovisual control system.

D. Samples:

1. Finish for control panels, racks, cabinets, and loudspeaker grilles.
2. Mechanical connectors for use in wiring.

1.07 TEST REPORT SUBMITTALS

A. Test Reports: Upon completion of SYSTEM PERFORMANCE TESTS AND ADJUSTMENTS specified in PART 3 - EXECUTION, submit for approval in writing test results including numerical values for measurements. Also submit written certification that the installation conforms to specifications, is complete and operable, and is ready for FINAL ADJUSTMENTS AND ACCEPTANCE TESTS specified in PART 3 - EXECUTION. Provide three (3) copies unless otherwise specified.

1.08 AS-BUILT DRAWING AND OPERATION MANUAL SUBMISSIONS

A. Operation and Maintenance Data - Coordinate with Section 01700

1. Draft Copies: At time of FINAL ADJUSTMENTS AND ACCEPTANCE TESTS specified in PART 3 - EXECUTION, provide draft copies of specified diagrams, schedules, and manuals for inspection during demonstration and acceptance testing. Submit final copies of documents within 30 days of project acceptance date. Drawings shall be drawn using the current version of AutoCAD. For Contractor-prepared drawings, schedules and instructions provide (1) draft copy and (2) final copies in electronic format for inclusion in the specified Complete Instruction and Maintenance Manual.
2. Functional Diagrams: Simplified single line block diagram showing interconnection of major equipment components and functional relationships. Illustrate receptacles, patch panel jacks, attenuators, transformers, switches, and loudspeakers. Key each patch panel jack to the patch bay by row and jack number. Diagram shall not illustrate terminal or interconnection cable number designations The Functional Diagram included with these specifications, modified to exclude details, transformer tap designations, etc., and to provide the information described above and any as-built changes, is suitable for this purpose. Mount a copy of the functional diagram behind clear plastic adjacent to the equipment rack(s) to which it applies.
3. As-Built Diagrams:
    a. The intent of the diagrams is to provide sufficiently clear and complete information that a technician of average skill may efficiently troubleshoot and service the system, even if unfamiliar with the installation.
    b. Provide drawings showing terminal blocks, connectors, relays, switches, transformers, attenuators, equipment components, and wires. Label devices with manufacturer, model number, and reference number (e.g. "SW 15," "TB 6"); reference numbers shall be consistent across drawings with no repetitions. As a minimum, provide an expanded version of the functional diagrams with cables fanned out at termination points and labeling as specified above; provide additional drawings where system complexity does not permit complete information to be shown legibly on an individual sheet no larger than the project sheet size. Provide labels for cables continued onto another drawing, indicating termination device, terminal numbers, and drawing sheet on which the termination is shown.
    c. As-built drawings are to include full connection information for each termination of conductors within a cable, either on the drawing itself via cable breakouts or by designating the connection type and providing separate details for each connection type.
    d. Provide layout drawings of panels and other custom assemblies containing switches, relays, terminal blocks, receptacles, etc., using reference numbers to identify physical locations of devices or label devices with reference numbers in a location visible while viewing cable terminations. On wiring diagrams, label conductors within cables for insulation color or other identifier. Label connectors, barrier strips, switches, relay sockets, etc., for terminal number. If device does not provide terminal designations, provide key diagram for reference.
4. Receptacle Location Plan: Plan of area showing locations and designations of receptacles.
5. Building Plan: Plan drawing of the building indicating the areas covered by the various zone volume controls.
6. Patch Panel Assignment Schedule: Mount a typed schedule of patch panel assignments behind acrylic at the equipment racks.
7. Spare Parts List: List of consumable spare parts (projector lamps, air filters, etc.) with part numbers.
8. Control Setting Schedule: Fully document the settings of non-user-adjustable controls. This includes power amplifier gain controls, equalizer settings, etc.

9. Complete Instruction and Maintenance Manual: Prepare in the form of an instructional manual for use by Owner's personnel. Provide one (1) draft copy and two (2) final copies unless otherwise specified.
10. Format:
    a. Original Owner and Maintenance Manuals provided from manufacturer or high-quality color reproductions.
    b. Drawings: Provide sequenced bound drawings in project standard size.
11. Content of Manuals:
    a. Provide a table of contents arranged in systematic order. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
    b. Contractor, name of responsible principal, address and telephone number.
    c. Certificate of Warranty for the system as a whole as well as copies of the manufacturer's warranty for each equipment item.
    d. Service Contract. Include a preliminary schedule for the specified semi-annual site visits.
    e. Complete as-built diagram(s) for systems.
    f. Functional Diagram(s).
    g. Receptacle Location Plan(s).
    h. Patch Panel Assignment Schedule.
    i. Building Plan(s).
    j. Original copies, high-quality laser printer printouts of PDF files, or high-quality photocopies of manufacturers' installation, operation, and service manuals, including schematic diagrams for each equipment item.
    k. Shop drawings of custom-fabricated items.
    l. Control Setting Schedule.
    m. Audiovisual Control System:
        1) Color printouts of touch screens control panel graphic layouts, as installed.
        2) Listing of system brand, models and associated peripherals.
        3) DVD or USB flash drive containing the master program for the system, the touch screen display program (including macros), programming, communication, or other project-specific software required for re-programming, and a limited license agreement for the use and modification of contractor-generated source code in connection with the maintenance and modification of the system for which it was written.
    n. Software for Programmable Devices: Where a computer has been used in programming system components, provide DVD or USB flash drive containing the software, instructions for making interconnections to the programmed devices for the purpose of modifying the programming, and a limited license agreement for the use and modification of contractor-generated source code in connection with the maintenance and modification of the system for which it was written.
    o. Applicable software and hardware licenses to be documented and original copies of the licensed provided to owner.

B. Upon request, bid drawings will be sent via egnyte file sharing. Requests must include the project name, project number, drawing numbers and type of files requested. Requests should be forwarded to:

Brian L. Masiello, CTS
Acentech Incorporated
33 Moulton Street
Cambridge, MA 02138

Tel: 617-499-8000, Fax: (617) 499-8074
Reference: Job Number: 633808

1.09 JOB CONDITIONS

A. Sequencing and Scheduling:

1. Coordinate work with adjacent work of other trades to facilitate construction and prevent conflicts.
2. Afford other trades reasonable opportunity for installation of work and for the storage of materials.
3. Staff the job to keep pace with the other Trades.
4. Abide by the decision of the Architect in case of conflict or interference by other trades.
5. Refuse: Remove refuse from the job site to the satisfaction of the Architect and Owner.

B. Insurance on the work of this specialty trade shall be provided as specified in Section 00810.

1.10 WARRANTY

A. Warrant equipment to be free of faulty workmanship and defects, and from damage due to contamination by construction dust and debris for a minimum period of one year from date of final acceptance.
B. Warrant repairs to "existing" equipment for a period of 90 days.
C. Emergency service: Within 24 hours of notification, restore the system to operation, replacing defective materials and repairing faulty workmanship. Make temporary repairs and provide loaner equipment at no charge if defective materials cannot be permanently replaced or repaired within this 24 hour time period.
D. Paint and exterior finishes, fuses, lamps, and projection lamps excluded from above warranties except when damage or failure results from defective materials or workmanship covered by warranty.
E. The minimum warranty provisions specified above shall not diminish the terms of individual equipment manufacturers' warranties.

1.11 SERVICE CONTRACT

A. Provide a one-year service contract to commence after acceptance of installation without additional cost. Service to include two semi-annual visits to the site for routine adjustment and maintenance of equipment. Provide a preliminary schedule for the semiannual visits.
B. Toward the end of each year's Service Contract, provide the owner with a proposal for continued service during the next year.

1.12 TRAINING

A. The Owner may assign personnel to participate with the contractor during installation. Without delaying the work, familiarize the Owner's personnel with the installation, equipment, and maintenance.
B. During tests and adjustments, permit the Owner's personnel to observe. When feasible explain the significance of each test.
C. Provide sufficient training to personnel selected by the Owner on operation and basic maintenance of systems and equipment. Explain operation of control systems, set-up, and operation of individual pieces of equipment and functions of overall systems.
D. Separate from the bid response quotation; provide an hourly cost for additional training.

1.13 INSPECTION

A. Notify the Architect of any defects in work by other trades affecting installation.

PART 2 - PRODUCTS

2.01 MICROPHONES AND ACCESSORIES

A. Wireless Microphone System:

1. Four-Channel Wireless Microphone Receiver:

   a. Performance requirements:

      1) Four receivers in a rugged 1RU metal chassis with internal power supply.
      2) Individual gain controls, LED meters, and XLR outputs for each channel.
      3) RF cascade ports allow distribution of RF signal to another unit.
      4) AES 256-bit encryption-enabled for secure transmission.
      5) Dante digital networked audio over Ethernet.
      6) Ethernet networking for streamlined frequency coordination and deployment across multiple receivers.
      7) Intuitive front panel LCD menu and controls with lockout feature.
      8) Switchable mic/line output level.
      9) Remote-able ½ wave antennas.

   b. Acceptable Products:

      1) Shure ULXD4Q series receiver with UA820 half-wave antennas, as required. Provide channel count, as required.
      2) Approved equal.

2. Wireless Hand-Held Microphone:

   a. Performance requirements:

      1) Backlit LCD with easy to navigate menu and controls.
      2) Rugged metal construction.
      3) Frequency and power lockout.

   b. Acceptable Products:

      1) Shure ULXD2/SM58 (Dynamic Handheld) with SB900 rechargeable battery and SBC200 battery charger.
      2) Approved equal.

3. Body-Pack Transmitter:

   a. Performance requirements:
   b. Backlit LCD with easy to navigate menu and controls.
   c. Rugged metal construction.
   d. Detachable ¼ wave antenna.
   e. Frequency and power lockout.
   f. Acceptable Products:

      1) Shure ULXD1 with SB900 rechargeable battery and SBC200 battery charger.
      2) Approved equal.

4. Lavaliere Microphone:

   a. Subminiature condenser microphone
   b. Acceptable Products:

1) Shure WL93 with appropriate transmitter connector.
2) Approved equal.

5. Antenna Amplifier:

a. Acceptable Products:

1) Shure UA221 with accessories, as required. AV contractor to verify quantity required with manufacturer.
2) Approved equal.

B. Ceiling Microphone (M1)

1. Cardioid directional condenser microphone mounted on flexible 4-inch flexible gooseneck.
2. Minimum Performance Characteristics:

a. Cardiod polar pattern.
b. Frequency Response: 50 to 17,000 Hz.
c. Output Impedance: 180 ohms.
d. Sensitivity: -35.0 dBV/Pa (17.8 mV).
e. Maximum SPL: 124.2 dB.
f. Signal to Noise Radio (ref 94 dB SPL): 66dB.
g. Provide color as directed by architect.

3. Acceptable Products:

a. Shure MX202x/C.
b. Audio-Technica U853A.
c. AKG HM1000.
d. Approved equal.

C. Stereo Recording Microphone (MR)

1. Stereo microphone shall be aimed towards the performance area.
2. Minimum Performance Characteristics:

a. Element: Fixed-charge back plate, permanently polarized condenser
b. Polar Patter: Cardioid.
c. Frequency Response: 30-20,000 Hz.
d. Impedance: Phantom: 200 ohms.
e. Signal to Noise Ratio: 70 dB, 1 kHz at 1 Pa.
f. Output Connector: Integral 3-pin XLRM-type.
g. Phantom powered.

3. Acceptable Products:

a. One (1) Shure VP88 with cables and mounting accessories, as required.
b. Approved equal

2.02 AUDIO PROCESSING

A. Audio DSP

1. Provide system with inputs and outputs as indicated on the functional drawings.
2. Features:

a. Selectable audio inputs (balanced line level audio or microphone level).
b. Inputs fully matrix-able to outputs.
c. 24-bit DSP capable of limiters, matrix routing, delay, parametric/graphic equalizers, and high/low shelf equalization.
d. RS-232 control port.
e. Logic input/outputs for control.

3. Minimum Performance Requirements:

    a. Frequency Response: 20-20,000 Hz, ±0.5 dB.
    b. Distortion: 0.01% THD, 20-20,000 Hz, +10 dBu.
    c. Dynamic Range: 105 dB minimum, (A-weighted, 20Hz to 20kHz).
    d. Maximum Output: +24 dBu.

4. Acceptable Products:

    a. QSC Q-SYS Core 110f with Core 8 Flex input/output expander, SL-DAN-32-P 32x32 Dante license, and accessories, as required.
    b. Approved equal.

B. Line Level Input Adapter:

1. Line input with unbalance to balanced conversion.
2. Mono audio output.

    a. Acceptable Products:
    b. Radio Design Labs D-CIJ3. Coordinate color with Architect.
    c. Approved equal.

2.03 AUDIO SOURCES

A. USB/SD Audio Recorder

1. Rack mountable audio recorder with balanced audio inputs and outputs.
2. Features:

    a. Records to SD/SDHC and USB media in MP3 and WAV (up to 24-bit/44.1kHz).
    b. Balanced and unbalanced inputs and outputs.
    c. Front panel USB connection.
    d. Dual Record feature (records to two media options simultaneously for primary and backup recording).

3. Acceptable Products:

    a. Denon DN-300R.
    b. Approved equal.

B. Bluetooth Audio Interface

1. Features:

    a. Pairing one button pairing/connect process for standalone operation with LED indication of connection status.
    b. Defeatable pairing button for restricted use applications with 3rd party control systems.
    c. Dante digital audio transport.
    d. Two RCA and one 3.5mm stereo input.
    e. One 3.5mm stereo output on the front.
    f. 802.3af compliant PoE powered to work with compliant PoE network switch.

2. Acceptable Products:

    a. QSC/Atterotech un6IO-BT with accessories, as required.
    b. Approved equal.

2.04 AUDIO DISTRIBUTION AND POWER AMPLIFIER

A. 2-Channel Audio Amplifier Type 1

1. Two-channel power amplifier with continuous average output power all channels driven of 1200 watts (minimum) at 4-ohms or 8-ohms (600W/channel).
2. Features:
    a. Frequency Response: 8 Ohms, 2Hz-40kHz.
    b. Signal To Noise Ratio (A-weighted): > 112 dB.
    c. THD (at full rated power, 20Hz-20kHz): 0.05%.
    d. Gain: 32 dB.
    e. Cooling: Forced air, with temperature controlled fan.
3. Acceptable Products
    a. Crown DCi 2|600N.
    b. LabGruppen equivalent.
    c. QSC equivalent.
    d. Approved equal.

B. Audio Distribution Amplifier
1. Minimum Performance Requirements:
    a. Frequency Response: 10-20,000 Hz ± 0.25 dB.
    b. Hum and Noise: -92 dB, 20-20,000 Hz, unweighted, re +4 dBm at +15 dB gain.
    c. Input: 20K ohms, balanced, +25 dBv max.
    d. Outputs: Balanced.
    e. Gain Adjustment: -9 to +6 dB.
2. Provide with power supplies and mounting hardware as necessary.
3. Acceptable Products (Provide quantity, as required, for channels indicated on the Contract Drawings):
    a. Extron DA 6A.
    b. Radio Design Labs RU-ADA4D.
    c. Approved equal.

2.05 LOUDSPEAKERS

A. General:
1. All finishes for loudspeakers and mounting hardware are to be approved by the Architect and may include custom painting.
2. AV contractor to implement loudspeaker manufacturer's signal processing recommendations, sometimes referred to as the "box EQ" (FIR filters, if provided by manufacturer, or manually entered EQ settings) within the audio signal processor as one processing block. Additional equalization and tuning requirements ("room EQ") shall be implemented as a separate block within the audio signal processor.
3. Provide manufacturer commissioning and set-up for the steerable column loudspeakers.

B. Wall-Mounted Loudspeaker:
1. Minimum Performance Requirements:
    a. Sensitivity: 1.0 V (for rated power output)
    b. Freq. Range: 120 Hz to 18 kHz
    c. Max SPL: 102 dB peak,@ 100 Ft. (30.5 meters) (3-octave bandwidth centered at 2 kHz
    d. Power Consumption: Idle: 180 Watts1/8 Power: 360 W (onset of limiting)1/3 Power: 1260 W (hard limiting)
    e. Horiz. Dispersion:150° up to 3 kHz; 120° above 3 kHz

f. Vert. Opening Angle: 10°, 15° and 20°
g. Vert. Aiming Angle: Adjustable from -30° to +30°
h. Typical Throw: Up to 130 Ft. (40 meters)
i. Beam Control: Effective down to 400 Hz
j. System Latency: 8ms analog input to output
k. No. Transducers: 16 coaxial transducers, each having triple tweeters
l. No. Amp. Channels: 16
m. Inputs:

1) Analog Audio: 2 balanced inputs on Phoenix Connectors
2) AES/EBU: Phoenix Connector
3) Dual RJ45 connectors for Ethernet Control and Dante

n. Computer Controls:

1) Gain
2) Mute
3) On/Standby
4) Input Selection
5) Compression
6) 8-Band Parametric
7) EQ shelving & Rolloff Filters
8) Delay
9) Preset Configuration Selection

o. Status Indicators:

1) Power
2) Signal
3) Overdrive
4) Thermal
5) Mute
6) Input Pad
7) Preset Configuration Selection Readout

2. Acceptable Products:

a. Renkus Heinz Iconyx IC16-RD line array loudspeaker system with configuration software, approved finish, mounting hardware, and accessories, as required. Provide with manufacturer commissioning/tuning/adjustment.
b. Approved equal.

C. Subwoofer

1. Minimum Performance Requirements:

a. Sensitivity: 96 dB (1W/1m).
b. Freq. Range: 45 Hz to 120 Hz.
c. Max SPL: 129 dB peak.
d. Power: 500 W AES

2. Acceptable Products:

a. Renkus Heinz SX112.
b. Approved equal.

2.6 ASSISTIVE LISTENING

A. Assisted Listening System (ALS)

1. General:

a. Locate antenna for ALS no farther than 200’ from transmitter.
b. Provide with the sufficient receivers to meet the 2010 ADA standards with 25% of the receivers to be hearing-aid compatible.
c. ALS Transmitter:
d. Features:

1) Operates on 72MHz.
2) LED indicators for audio level, RF modulation, and RF output power.
3) Tunable to 57 wide and narrow band channels.

e. Minimum Performance Requirements:

1) RF Frequency Range: 72.025 – 75.950 MHz.
2) Transmitter Stability: 50PPM.
3) Output Power: 100mW.
4) Signal to Noise: 44dB.

f. Acceptable Products:

1) Listen Technologies LT-800 72 MHz base unit with power supply, & rack mount kit.
2) Approved equal.

2. ALS Antenna:

a. Acceptable Products:

1) LA-123 Antenna (mount on standard gang plate, finish approved by architect), provided with RG-8/U cable as required.
2) Approved equal.

3. Receiver:

a. Features:

1) 17 channel digital receiver.
2) LED indicators.

b. Minimum Performance Requirements.

1) RF Frequency Range: 72.025 – 75.950MHz.
2) Sensitivity: .6uV typical, 1uV maximum for 12dB SINAD.
3) Signal to Noise: 80dB.

c. Acceptable Products:

1) Listen Technologies LR-4200-072 with rechargeable batteries, LA-401 ear speaker, and iDSP neck loop. Provide quantity (3).
2) Approved equal.

4. Charging Station:

a. Features:

1) 12-unit charging tray.

b. Acceptable Products:

1) Listen Technologies LA-381-01. Provide charging stations to charge all receivers simultaneously.
2) Approved equal.

2.07 VIDEO SOURCES

A. Blu-Ray Player:

1. General: High-definition DVD player compatible with Blu-ray, standard DVD, and CD discs.
2. Features:
    a. Maximum output resolution: 4K Upscale (60p).
    b. Dolby Atmos (bitstream out) / Dolby TrueHD decoding (7.1ch).
    c. 4K streaming.
    d. Wifi: 2.4 GHz, 5 GHz.
    e. RS-232C control.
    f. Hand-held wireless remote control.
3. Acceptable Products:
    a. Sony UBP-X1100ES with rack mount hardware.
    b. Approved equal.

B. BYOD Receiver

1. Video source allowing wireless presentation of laptops, tablets, and smart phones.
2. Features:
    a. Fully managed over the network using SNMP.
    b. Wireless: Dual band, 802.11n 2x2 Mimo WiFi.
    c. OS support: Windows, OSX and Android.
    d. Output format: HDMI 1.4 output with Audio.
    e. Remotely managed and configured using any web browser.
    f. Streaming video support: 4K resolution (3840 x 2160), HD (1920x1080), HD SD (1280x720).
3. Acceptable Products:
    a. Mersive Solstice Pod Enterprise Unlimited with mounting accessories, as required.
    b. Crestron AM-3100-F with mounting accessories, as required.
    c. Approved equal.

2.08 VIDEO ROUTING AND PROCESSING

Note: The functional diagram(s) connections shown on the bid documents are based on components manufactured by QSC. This manufacturer was used only as a reference to show the signal flow for the completed audiovisual system. Crestron and Extron are approved equals. The contractor must supply any additional equipment required to provide a complete audiovisual system. Contractor is responsible for field-verifying all lengths of cable runs through conduit and to provide hardware required to allow video system to operate at full resolution.

A. Digital Media Transmitter

1. Features:
    a. 4K60 4:4:4 support
    b. HDR10, Deep Color, and 3D video
    c. Dolby® TrueHD, Dolby Atmos®, DTS HD®, and uncompressed 7.1 linear PCM audio
    d. HDBaseT® compatibility
    e. HDCP 2.2 compliance
    f. HDMI® input (DVI and Dual-Mode DisplayPort™ interface compatible)
    g. DM 8G+® output for connection to a DM® switcher or receiver via a single CAT5e (or higher) twisted pair cable

h. Transmission distance up to 330 ft (100 m) for resolutions up to UHD and 4K using DM Ultra cable
i. Transmission distance up to 330 ft (100 m) for 1080p, WUXGA, and 2K using DM 8G® cable or CAT5e
j. Transmission distance up to 230 ft (70 m) for UHD and 4K using DM 8G cable or up to 165 ft (50 m) using CAT5e
k. Device control via CEC, IR, and RS-232
l. Powered via the DM connection or local power pack (included)
m. Decorator-style faceplate and surface-mount bracket included

2. Acceptable Products:

a. Crestron DM-TX-4KZ-100-C-1G-x-T with color as approved by Architect, and accessories, as required.
b. Approved equal.

B. Digital Media Receiver

1. Features:

a. DigitalMedia 8G+® receiver and display controller
b. Connects to a DM® switcher or transmitter over a single CAT type twisted pair cable
c. HDBaseT® compatible
d. Provides one HDMI® or DVI display output
e. Handles UHD and 4K video resolutions up to 4K60 4:4:4
f. Handles HDR (High Dynamic Range) video (HDR10)
g. Handles 3D video and Deep Color
h. Handles Dolby® TrueHD, Dolby Atmos®, DTS HD®, DTS:X®, and uncompressed 7.1 linear PCM audio
i. HDCP 2.2 compliant
j. Supports cable lengths up to 330 ft (100 m) for all resolutions up to UHD and 4K
k. Supports cable lengths up to 330 ft (100 m) for 1080p, WUXGA, and 2K using DM 8G® cable or CAT5e
l. Supports cable lengths up to 230 ft (70 m) for UHD and 4K using DM 8G cable, or 165 ft (50 m) using CAT5e
m. Provides a 10/100 Ethernet LAN connection
n. Enables device control via CEC, IR, RS-232, and Ethernet

2. Acceptable Products:

a. Crestron DM-RMC-4KZ-100-C with accessories, as required.
b. Decora mount (mix location, R2 panel) Crestron DM-RMC-4K-100-C-1G-B-T.
c. Approved equal.

C. HDMI Switcher

1. Minimum Performance Requirements:

a. Video

1) Input Signal Types:
a) HDMI w/Deep Color, 3D, & 4K (DVI & DisplayPort Multimode compatible)

2) Output Signal Types:
a) HDMI w/Deep Color, 3D, & 4K (DVI compatible)

b. Audio:

1) Input Signal Types HDMI (DisplayPort Multimode compatible)
2) Output Signal Types HDMI

3) Formats Dolby Digital®, Dolby Digital EX, Dolby Digital Plus, Dolby TrueHD, DTS®, DTS-ES, DTS 96/24, DTS-HD High Res, DTS-HD Master Audio, LPCM up to 8 channels

c. Communications:

1) Ethernet 10/100 Mbps, auto-switching, auto-negotiating, auto-discovery, full/half duplex, DHCP, Web browser setup and control.
2) HDMI (Inputs) HDCP, EDID
3) HDMI (Output) HDCP, EDID, CEC

d. Connectors:

1) Inputs:
a) (4) 19-pin Type A HDMI female;
b) HDMI digital video/audio inputs;

2) Output:
a) (1) 19-pin Type A HDMI female;
b) HDMI digital video/audio output;

3) LAN:
a) 8-wire RJ45 female;
b) 10Base-T/100Base-TX Ethernet port

2. Acceptable Products:

a. Crestron HD-MD4X1-4K-E switch with power supply, rack-shelf, and accessories, as required.
b. Extron equivalent
c. Approved equal.

D. Network Video Endpoint:

1. Features:

a. Actively adjusts network bandwidth according to the content, affording massive network savings for common meeting room content.
b. Modes: Multicast and Unicast
c. Bitrates: 10 Mbps - 800 Mbps
d. Streaming Protocol: RTP
e. Content Protection: HDCP 2.2 compliant, AES-128 encryption for audio and video signals between encoders and decoders

2. Minimum Performance Requirements:

a. Encoding/Decoding

1) Video compression: Q-SYS Shift™ compression codec
2) Bitrates: 10 Mbps - 800 Mbps
3) Content protection: HDCP 2.2 compliant, AES-128 encryption for audio and video signals between encoders and decoders

3. Audio I/O

a. HDMI inputs: 8-channel PCM audio, Q-SYS routable
b. HDMI outputs: 8-channel PCM audio, Q-SYS routable
c. Analog input: 3.5 mm unbalanced stereo mic/line input, Q-SYS routable
d. Analog output: 3.5 mm unbalanced stereo line output, Q-SYS routable

4. Video I/O

a. HDMI 2.0 inputs: 3x HDMI capable of receiving source input video formats up to 4K60 4:4:4

b. HDMI 2.0 outputs: 2x HDMI capable of scaling and outputting video formats up to 4K60 4:4:4
c. 4K60 4:4:4 scaler

5. Connectors

a. RS-232: Three-pin Euroblock terminal connector for extension of Q-SYS control to third-party devices, user configurable
b. GPIO: Euroblock terminal connector for extension of Q-SYS control to third-party devices, user configurable
c. LAN A: Gigabit LAN connection for interfacing with Q-LAN. PoE 802.3bt Type 4 for power.

6. Acceptable Products:

a. QSC NV-32-H. Provide with accessories, as required.
b. Approved equal.

2.09 VIDEO DISPLAY

A. Motorized Video Projection Screen:

1. General:

a. Provide manufacturer's standard UL-labeled units consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation.
b. Single-Station Control: 3-position control switch with metal device box and cover plate for flush wall mounting and for connection to 120 VAC power supply.
c. Motor: Instant-reversing, end-mounted or in-roller motor of size and capacity recommended by screen manufacturer with permanently lubricated bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting.
d. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a min. 3/8-inch (9.5 mm) diameter metal rod with ends of rod protected by plastic caps.

2. Electrically Operated Screen:

a. Front projection electric tensioned screen.
b. Features:

1) Screen edge tabs and tensioning cables to stretch screen fabric laterally to provide flat projection surface and extra drop.
2) Low-voltage control with one control station.
3) Screen Fabric: Flame retardant and mildew resistant.
4) Screen surface can be cleaned with mild soap and water.
5) Aspect Ratio: as indicated.
6) Viewing Angle: 85 degrees.
7) Gain: 1.1.
8) Extra Drop: As required.

c. Acceptable Products:

1) Da-lite Tensioned Advantage Projection Screen with HD Progressive 1.1 screen surface and custom black drop, as required. Refer to AV contract drawings for dimensions..
2) Approved equal.

B. Video Projector:

a. Minimum Performance Requirements:

1) Projector type: Single-chip DLP laser phosphor projector
2) Resolution: 3,840 x 2,400 (4K UHD) / 2,716 x 1,600 (WQQXGA+ native)
3) Brightness: 10,500 ANSI Lumens
4) Contrast ratio: 10,000:1
5) Aspect ratio (native): 16:10
6) Inputs & Outputs (min.):
   a) DVI-D
   b) HDMI
7) Communication & Control:
   a) LAN
   b) RS232
8) Optical lens shift, as required.

b. Acceptable Products:

1) Barco F90-4K13 with appropriate zoom lens, as required. Provide with installation and mounting hardware, spare filter, and accessories, as required.
2) Approved equal.

2.10 CONTROL SYSTEMS

A. Custom Audiovisual Control System Software/Programming:

1. Custom software and programming for AV control system control panels and mainframes to provide control of AV devices and user-friendly control interface.
2. Programming provided by a programming service company engaged in providing such services to third parties as a principal business activity.
3. Product to be developed using AV control system manufacturer's programming tools and to include touch panel layouts, programming source and compiled code, and written documentation. Product to exploit full graphical capabilities of control system hardware and maximum available feedback of controlled equipment.
4. Control functions as itemized in parts 1 and 3 of the audiovisual specification and on the contract drawings.
5. Product shall conform project standards, including colors, logos, etc.
6. Acceptable Products:

   a. Custom software and documentation from certified in-house programming staff or other sub-contractor as approved according to Division 1. Provide touch panel layouts as required under Part 1.6 - Submittals.

B. AV Control System:

1. Fully integrated, programmable system for control of audiovisual system equipment and other motorized, electronic or electrical devices that can be remote controlled.
2. Features:

   a. Supports 4-wire control network operation for interfacing with outboard, remote devices including control modules and control panels.
   b. Supports 8-wire LAN/Ethernet expansion of the control network.
   c. Programmable with high level language via external PC or Apple computer (computer not provided.)
   d. Rack mountable.

3. Control Ports:

a. Ethernet: 8-wire RJ-type connector.
b. Relays: (8) normally opened, isolated relays rated at 1A, 30VAC/DC.
c. Input/Output: (8) programmable input and digital outputs.
d. IR/Serial: (8) serial outputs for IR, or serial interface.
e. COM: (3) bidirectional serial ports for RS-232, RS-422 or RS-485 communication.
f. Net: (1) 4-pin male connector for control network.

4. Listing below indicates the basis of the system. The contractor is responsible to review this configuration and supply all programming and any additional components required to make a fully-functional system.
5. Acceptable Products:

a. Crestron 4-Series System with the following Components

1) CP4 control processor.
2) Power supplies, cables, and miscellaneous accessories as required.
3) Approved equal.

C. Wall Mounted 7” Touch Panel

1. A 7” LCD panel with touch sensitive screen.

a. Features:

1) Touchscreen:
a) Display Type: TFT active matrix color LCD.
b) Screen Dimensions: 7” diagonal.
c) Resolution: 1280x800 pixels.
d) Contrast: 850:1

2) Communications protocol compatible with respective integrated control system.
3) Communications: 10/100 Mbps Ethernet with LAN PoE.
4) Mounts to 2-gang box.
5) Provide with protective cover in Gym.

b. Acceptable Products:

1) Crestron TSW-770-x-S with mounting hardware. Provide in finish as approved by Architect.
2) Approved equal.

D. AV Network Switch:

1. Features:

a. RLinkX (Link redundancy): Yes
b. Groups (VLAN segmentation): Yes
c. MultiLinkX (Link aggregation): Yes
d. Profile manager: Yes
e. Memory: 4Mb
f. MAC address table:
g. Address learning / Aging: Self learning, Auto aging
h. Switching throughput: 52Gbps
i. IGMP support: Yes (V1/V2/V3)
j. IGMP snooping: Yes, enabled by default
k. Port sensing: Auto negotiation
l. Auto crossover: MDI / MDIX
m. Auto sensing: Full or Half Duplex (Gigabit is Full Duplex)
n. PoE budget (190 watts) minimum.

2. Connectivity:

a. Ethernet connectivity: 24 x RJ45 connectors (incl. 4x dual media on ports 21-24)
b. Fiber connectivity: 6 x SFP cages (incl. 4x dual media on ports 21-24)
c. Ethernet port speed: 1Gbps
d. Serial: 1 x serial RJ45 console port

3. Protocols:

a. Supported protocols: Avnu AVB/MILAN, Dante©, RAVENNA/AES67©, Ethersound©, Q-LAN, REAC©, sACN, ArtNet, MANet2, HogNet, RTTrPL (BlackTraX), IEEE 802.1p CoS (Class of Service), DiffServ (DSCP), PoE (802.3af) (optional), PoE+ (optional), IEEE 1588 PTP V2
b. Sound protocol compliance: Yes (low jitter)
c. Ethernet compliance: IEEE 802.3, IEEE 802.3u, IEEE 802.3x Flow Control, IEEE 802.3ab Gigabit Ethernet

4. Provide stacked network switches as necessary to provide port count shown on AV drawings.
5. Acceptable Products:

a. QSC NS series with accessories, as required. Configure with VLANs to separate AV network traffic from Owner network (coordinate with Owner).
b. Luminex Gigacore 26i with PoE supply. Provide with accessories, as required. Configure with VLANs to separate AV network traffic from Owner network (coordinate with Owner).
c. Pakedge equivalent. Configure with VLANs to separate AV network traffic from Owner network (coordinate with Owner).
d. Approved equal.

E. Uninterruptible Power Supply (UPS):

1. Provide UPS for power protection of the digital audio signal processor (DSP), digital video switch, and control system during periods of power shortages. Allow for proper shutdown of these devices during power outage via control system programming.
2. Features:

a. Load Rating: 8.3A
b. Voltage Rating: 120V
c. Under-Voltage Auto Shutdown: Yes
d. Over-Voltage Auto Shutdown: Yes
e. Over-Current Auto Shutdown: Circuit Breaker

3. Acceptable Products:

a. SurgeX UPS-1000-OL with SNMP network card, rack ears, and accessories, as required.
b. APC equivalent.
c. Approved equal.

2.11 RACKS, CARTS, AND MOUNTS

A. General:

1. VERIFY ALL RACK SIZES, TYPES AND FINISHES WITH CONSTRUCTION MANAGER OR PROJECT MANAGER BEFORE ORDERING.
2. VERIFY AND COORDINATE ALL BLOCKING AND CLEARANCE REQUIREMENTS BEFORE ORDERING.
3. Equipment rack for standard 19" wide panels. Minimum 16-gauge cold rolled steel construction with louvered sides. Mounting rails with tapped 10-32 threaded holes on EIA spacings. Welded construction.

4. Each rack furnished with permanently-mounted AC power 3 conductor grounded rack, and with incandescent illumination attached for ease in servicing.

B. AV Equipment Rack:

1. Welded floor rack assembly provided with side panels, lockable rear door and adjustable rear mounting rails, lacing bars and power distribution.
2. Features:

    a. Height as indicated or required
    b. Power for all rack equipment controlled by single master switch/power sequencer and vertical AC power raceway.
    c. Vent panels, blank panels and rack mount shelves as shown on drawings.
    d. Provide top panel with temperature controlled fan unit.
    e. Provide caster bases and casters where necessary for service access

3. Acceptable Products:

    a. Middle Atlantic Products ERK-4425 with rear rack rails, AC power distribution, vented top panel with temperature controlled fan unit, and locking doors, and caster base.
    b. Lowell equivalent.
    c. Atlas Sound equivalent.
    d. Approved equal.

C. Rack Mounted AC Power Sequencer:

1. Rack-mounted sequential power controller providing time-sequenced activation and de-activation of equipment with integrated system power switch.
2. Features:

    a. Front panel actuation switch.
    b. Alarm interface.
    c. Four (minimum) sequencing steps.
    d. Front AC outlet.
    e. LED status indicator.
    f. 20A, 9 outlet.

3. Acceptable Products:

    a. Lowell ACR-SEQ6-2009.
    b. Equivalent.

D. AC Receptacle(s) & Raceway:

1. AC power receptacles for power distribution in equipment racks and cabinets.
2. Features:

    a. UL Recognized
    b. Multiple circuit strip.
    c. 20 Amp power rating.
    d. Isolated Ground.

3. Acceptable Products:

    a. Middle Atlantic MPR series, as required. Provide with compatible power raceway, as required.
    b. Lowell POWERSTAC Series, as required. Provide with compatible power raceway, as required.
    c. Equivalent.

E. Blank Panels:

1. 16-gauge flanged solid steel with black smooth ended for or textured enamel finish.
2. Acceptable Products:
    a. Middle Atlantic SB series.
    b. Atlas Sound S19 series.
    c. Lowell AFP series.
    d. Approved equal.

F. Vent Panels:
1. 16-gauge flanged perforated steel with black smooth or textured enamel finish.
2. Acceptable Products:
    a. Middle Atlantic VTF series.
    b. Atlas Sound SVP19 series.
    c. Lowell SVP series.
    d. Approved equal.

G. Rack Drawer:
1. Lockable rack mount heavy-duty drawer with spring latch to keep drawer closed.
2. Acceptable Products:
    a. Middle Atlantic D series drawers. Size as indicated on drawings.
    b. Atlas Sound SD series, size as indicated on contract drawings.
    c. Lowell UDE series, size as indicated on contract drawings.
    d. Approved equal.

H. Pull Out Rack Shelf:
1. General: Slide out rack-shelf for support of portable equipment, capable of latching in open position.
2. Acceptable Products:
    a. Middle Atlantic SS.
    b. Lowell SLS.
    c. Approved equal.

I. Fixed Rack Shelf:
1. General: Universal rack-shelf for non-rack mount equipment.
2. Acceptable Products:
    a. Middle Atlantic U1.
    b. Atlas Sound SH1-10.
    c. Lowell US-110.
    d. Approved equal

J. Brush Grommet Panel
1. Acceptable Products:
    a. Middle Atlantic BR2.
    b. Lowell CBP -2.
    c. Equivalent.

K. Security Screws:
1. Star-post or similar security head rack screws to inhibit unauthorized removal of equipment from racks.
2. Acceptable Products:
    a. Middle Atlantic Products HTX screws (provide two TBIT bits).
    b. Equivalent.

L. Security Covers:

1. Perforated cover panels to prevent unauthorized tampering with equipment controls. Panels to provide 22% open area to allow viewing of LED indicators and controls. Opposing corner notches to allow equipment to stay racked when cover is removed.
2. Acceptable Products:

   a. Middle Atlantic SF series.
   b. Equivalent.

M. Rack Exposed Trim Hardware:

1. All exposed rack hardware on the front face of the rack, including rack screw trim strips, ventilation panels and blank panels, provided with brushed and black anodized finishes.
2. All rack equipment installed with shims as may be required so that the faces of all equipment, vent and blank panels are flush.
3. Acceptable Products:

   a. Middle Atlantic Products TSA rack screw trim strips and ST-series shim tabs.
   b. Equivalent.

N. Cable Management:

1. Rear mounted Horizontal and vertical lacing strips, as required, to ease cable management and secure service loops.
2. Acceptable Products:

   a. Middle Atlantic LBP-1.5 and LACE/LACE-44-1s.
   b. Equivalent.

2.12 CABLE

A. The following tables list the cabling and connectors that have been approved for the project. This is not an all-inclusive list of the cabling required to complete the installation and fabrication of the audiovisual systems. The contractor may submit cable part numbers, models, and product data for cable that is not listed in the table for approval by the consultant.

Application	Description	Manufacturer	Model No.	Comments
Audio				
Microphone	22 AWG STP	West Penn Belden Liberty	291 8761 22-2C-SH-GRY	Equal
Microphone/Line Level (Plenum)	22 AWG STP	West Penn Belden Liberty	25291 88761, 87761 22-2C-PSH-WHT	Equal
Line Level	20 AWG STP	West Penn Belden Liberty	292 8762 20-2C-SH-GRY	Equal
Intercom	20 AWG STP	West Penn Belden Liberty	292 8762 20-2C-SH-GRY	Equal
Speaker Low Z - Mains and Subwoofers	10 AWG UTP	West Penn	HA210	Equal

Speaker Mains	12 AWG UTP	West Penn Belden Liberty	227 8477 10-2C-GRY	Equal
Speaker Mains (Plenum)	12 AWG UTP	West Penn Extron Liberty	25227 SPK-14 12-2C-P-WHT	Equal
Speaker General Purpose	14 AWG UTP	West Penn Belden Liberty	226 8473 14-2C-GRY	Equal
Speaker General Purpose (Plenum)	14 AWG UTP	West Penn Extron Liberty	25226 SPK-14 Plenum 14-2C-P-WHT	Equal
Speaker General Purpose	16 AWG UTP	West Penn Belden Liberty	225 8471 16-2C-GRY	Equal
Speaker General Purpose (Plenum)	16 AWG UTP	West Penn Extron Liberty	25225 SPK-16 Plenum 16-2C-P-WHT	Equal
Speaker General Purpose	18 AWG UTP	West Penn Belden Liberty	224 8461 18-2C-GRY	Equal
Speaker General Purpose (Plenum)	18 AWG UTP	West Penn Extron Liberty Belden	25224 SPK-18 Plenum 18-wC-P-WHT 89740	Equal
Video				
3G-SDI	SMPTE 424M	Belden	1694D, 1794A, 7731A (verify cable length in conduit when selecting cable part number to ensure compatibility with 3G-SDI)	Equal
Control and Data				
ALS Antenna	50 Ohm Coax RG-8U	West Penn Belden Liberty	810 7733A RG8-CMP-BLK	Equal
Category 5e	23 AWG UTP	West Penn Belden Liberty	4245 DataTwist 1200 24-4P-L5-EN	Equal
Category 6	23 AWG UTP	West Penn Belden Liberty	4246 DataTwist 2400 24-4P-L6	Equal
Category 6 (Plenum)	24 AWG UTP	Belden Liberty	DataTwist 7882A 24-4P-P-L6	Equal
RS232/422	24 AWG STP	West Penn Belden Black Box	D2404 9925 Series Extended Distance Data Cable	Equal
Crestnet/AXLink	2-18 AWG UTP with 2-22 AWG STP	West Penn Liberty Crestron	77350 Cresnet/AXLINK CRESNET-NP	Equal
Crestron/AXLINK (Plenum)	2-18 AWG UTP with 2-22 AWG STP	Liberty	Cresnet-P AXLINK-P	Equal

Crestron DigitalMedia	4 pr 24AWG STP (shielded)	Crestron	DM-CBL-3G-NP	No Equal
Crestron Fiber Optic DigitalMedia	OM3 Type 50/125um x 4 Multimode Fiber	Crestron	CRESFIBER8G-NP	No Equal
Extron XTP DTP	4 pr 24AWG STP (shielded)	Extron	XTP DTP 24/1000	No Equal
Extron Fiber Optic XTP	OM4 Type 50/125um x2 Multimode Fiber	Extron	OM4 MM P	No Equal
Interface Cables				
HDMI Interface Cable	High-speed Category 2 HDMI Cable w/locking connectors	Crestron Perfect Path	CBL-HD-LOCK 700 Series	Equal
DVI Interface Cable	Dual Link DVI-D	Crestron	CBL-DVI	Equal
Display Port	DisplayPort 1.2 cable 25’	Extron	26-657-25	Equal
25' Microphone, Line, and Intercom	22 AWG STP	Whirlwind Wireworks	WMKPVC-25 C-25	Equal
50' Microphone and Intercom	22 AWG STP	Whirlwind Wireworks	WMKPVC-50 C-50	Equal
25' Monitor Speaker	12 AWG UTP	Whirlwind Pro Co	SK525G12 S12NN-25	Equal

2.13 APPROVED CONNECTORS

A. Connectors listed below are suggested for use with the specified cabling. The list may not include all of the connectors required to complete the installation of the systems. If a different cable is submitted for approval by the consultant, provide the appropriate connector for the cable as part of the cable submission.

Application	Description	Manufacturer	Model No.	Comments
Audio				
Mic/Line/Intercom	XLR Male Panel Mount	Neutrik Swtichcraft	NC3MX A3M	Equal
Mic/Line/Intercom	XLR Female Panel Mount	Neutrik Switchcraft	NC3FD D3F	Equal
Combo Line	XLR plus ¼” Phone Panel Mount	Neutrik	NCJ5FI-S	Equal
Mic/Line/Intercom	XLR Male Inline Cable	Neutrik Switchcraft	NC3MD A3M	Equal
Mic/Line/Intercom	XLR Female Inline Cable	Neutrik Switchcraft	NC3FD A3F	Equal
Mic/Line Multipin	12 Pair Female Panel Mount	Whirlwind	W1CM	Equal
Mic/Line Multipin	12 Pair Male Inline Cable	Whirlwind	W1IM	Equal

Mic Broadcast	DT-12 Male Inline Cable	Whirlwind	DT12IM	Equal
Mic Broadcast	DT-12 Female Panel Mount	Whirlwind	DT12CF	Equal
Speaker	4-Pole Panel Mount	Neutrik	NL4MP	Equal
Speaker	8-Pole Panel Mount	Neutrik	NL8MPR	Equal
Speaker	4-Pole Inline Cable	Neutrik	NL4FC	Equal
Speaker	8-Pole Inline Cable	Neutrik	NL8FC	Equal
Video				
Recessed Video Receptacle	75 Ohm Pass-Thru	Canare	BCJ-JRU	Equal
Control and Data				
50 Ohm ALS Ant.	50 Ohm BNC Cable Mount	West Penn	CN-BM53-13	Equal
Ruggedized RJ-45 Cat 5 Receptacle	Ruggedized RJ-45 Panel Mount	Neutrik	NE8FDV-YK-B	Equal
Ruggedized RJ-45 Cat 5 Connector	Ruggedized RJ-45 Inline Cable	Neutrik	NE8MC-1	Equal
Ruggedized RJ-45 Cat 6 Receptacle	Ruggedized RJ-45 Panel Mount	Neutrik	NE8FDY-C6-B	Equal
Ruggedized RJ-45 Cat 6 Connector	Ruggedized RJ-45 Inline Cable	Neutrik	NE8MC6-M0	Equal
Cat 6a Panel Connector	D-shape CAT6A panel connector, shielded, IDC termination, nickel housing	Neutrik	NE8DX-Y6	Equal
Cat 6a Panel Connector	D-shape CAT6A panel connector, shielded, IDC termination, nickel housing	Neutrik	NE*FDX-Y6-B	Equal
RS232 Receptacle	RS232 Panel Mount Male	Amphenol	DB9S-SFJ	Equal
RS232 Receptacle	RS232 Panel Mount Female	Amphenol	DB9S-SMJ	Equal
RS232 Connector	RS232 Inline Cable	Amphenol	DB9S-SFJ or DB9S-SMJ w/metal backshell	Equal
Crestron DM Connector	Shielded RJ45	Crestron	DM-Conn	No Equal
Crestron DM Fiber Optic	SC 50um Fiber Connector	Crestron	CRESFIBER-CONN-SC50UM-12	No Equal

2.14 MISCELLANEOUS

A. Receptacle Back-Box Covers:

1. General: Appearance and finish as approved by Architect. Provided with engraved legends as specified and shown on drawings.
2. Standard NEMA Gang-Size Covers: Single or multi-gang steel covers, punched as required to receive receptacles.
3. Custom Covers for Large Backboxes: Min. 1/8" thick aluminum or steel covers, punched as required to receive receptacles.
4. Catwalk receptacle panels shall be “Bell” box type covers leaving no sharp edges exposed.

B. Receptacle Panels:

1. 1/8” thick aluminum with a black anodized finish and white engraved lettering.
2. Submit plate finishes to Architect and Audiovisual Consultant prior to fabricating panels.

C. Custom Rack Panels:

1. 1/8” thick aluminum with a black anodized finish and white engraved lettering.

PART 3 - EXECUTION

3.01 GENERAL

A. All types of equipment installed by competent workers at locations shown on the drawings in strict accordance with approved shop drawings and manufacturer's instructions.
B. All equipment except portable equipment firmly held in place. This shall include loudspeakers, enclosures, amplifiers, cables, etc. Fastenings and supports adequate to support their loads with a safety factor of at least three unless otherwise stated.
C. Take such precautions as necessary to prevent and guard against electro-magnetic and electro-static hum and to install the equipment so as to provide safety for the operator.
D. Protect all equipment, including patch panels, connectors, receptacles, racks, consoles, and video projectors, from construction dust and debris until final acceptance of the system.
E. No electronic or projection equipment shall arrive on-site until the project construction has reached interior finishes phase. No audiovisual equipment shall be on-site until conditions are dry, dust-free, and air-conditioned. (Carpet and painting nearing completion.)

3.02 EXAMINATION

A. Notify the Architect of any defects in work by other trades or other conditions affecting installation.

3.03 LABELS

A. Except where otherwise specified, label as shown on drawings and as specified each item of rack-mounted equipment, all switches, controls, and receptacles.

1. Switch and Control Panels: Constructed of engraved and filled anodized aluminum plates. Minimum 1/8" plate thickness. Dry transfer or other types of adhesive labels not acceptable.

2. Rack-Mounted Equipment: Labels constructed of engraved and filled plastic laminate engraving stock. Designate function and input and output line(s) or loudspeaker(s) served by labeled equipment. Key all designations to system functional and patch panel diagrams. Where possible, mount labels on blank panel directly above corresponding component. For modular equipment, provide label on inside of mainframe door identifying type of module for each slot (unless there is only one type) and gain setting as established at final checkout.
3. Identification Panel: Install panel with 1/8"-high engraved characters on the front of the bank of equipment racks serving each space. Clearly identify the Project, System Installation Contractor, Architect, and System Designer in the following format:

PROJECT:	Owner's Name Address Room or spaces served Owner's technical support telephone
SYSTEM DESIGNER:	Acentech Incorporated 33 Moulton Street Cambridge, MA 02138 (617) 499-8000
SYSTEM INSTALLER:	Company Name Address Telephone
PROJECT ARCHITECT:	Company Name Address Telephone

4. Receptacles: Engrave and fill receptacle label directly on mounting plate as follows:
   a. Microphone Receptacles: Engraved "MIC", with circuit number corresponding to drawings.
   b. Line-Level Receptacles: Engraved "LINE", with circuit number corresponding to drawings.
   c. Production Communication Receptacles: Engraved "PC".
   d. Camera Receptacles: Engraved "CAMERA" with circuit designation corresponding to drawings.
   e. Video Receptacles: Engraved "VIDEO" with circuit designation corresponding to drawings.
   f. Remote Control Receptacles: Engraved "RC" with designation of item to be controlled.
   g. Loudspeaker Receptacles: Engraved "LS" with circuit number corresponding to drawings.
   h. Or as indicated on drawings.
5. Patch Panels: Labels for jacks constructed of engraved and filled plastic laminate engraving stock or printable composition material with clear plastic cover. Labels for jack rows constructed of engraved and filled plastic laminate engraving stock. Paper strips may be used as temporary labels only.
   a. Label jacks with functional description of jack ("Main Cluster EQ Out", "Console Mic Input 4", etc.)

b. Color-code jack labels with different colors for microphone level jacks, input and output jacks for recording/playback equipment, miscellaneous devices such as pads or multiples, and other line-level jacks.

B. Identify all wires and cables at every termination and connection point with the specified cable markers. The contractor is strongly encouraged to use a numbering scheme that identifies all cables terminating at patch panel jacks with the patch bay row and jack designation; use A, B, and C suffixes to distinguish multiple cables terminating at the same jack.
C. Identify switches, relays, terminal blocks, etc., with reference numbers keyed to the as-built wiring diagrams.
D. Room numbers appear on the contract documents for reference only. All labels shall reflect the Owner's final room designations.
E. All labels and legends shall be as approved on shop drawings.
F. Cable Markers:

1. High-grade PVC clip-on or permanent-type cable markers with permanent markings, or printed vinyl tape protected by clear shrink tubing or adhesive wrap.

3.04 SYSTEM DEMONSTRATION AND CHECKOUT (COMMISSIONING)

A. System installation will be certified complete and in fully adjusted working order by contractor. Fill in and submit the AVIXA Audiovisual Systems Performance Verification Checklist form prior to scheduling formal commissioning.
B. Fully Adjusted Working Order requires a system to be functional, set for normal operating conditions, and ready to be demonstrated to the AV consultant and end users for training and operation. This includes: termination of field and internal equipment rack cabling, cable labels, equipment labeling, installation of control system code, testing of devices under touch panel or button panel control, remote control panels, external control sensors, IP and network settings, image adjustments, audio mixing, level and equalization adjustments, assistive listening tests, and external sub-system device control. Fully demonstrate spares or pool equipment supplied under the contract; including auxiliary interconnecting cables and accessories.
C. Confirm test results and data obtained and submitted for review during final commissioning, as requested.
D. Provide as-built drawings, manuals, and configuration software available to consultant during the final testing and commissioning. System Demonstration and Testing does not define the entire scope of proof of performance of the AV systems. Detailed performance requirements are listed in Section 3.14 below.

3.05 MICROPHONE EQUIPMENT

A. General:

1. Excluding wireless microphones, each portable microphone provided with case, stand adapter, and min. 15 ft. cable with attached XLR-type connector.

B. Cardioid Gooseneck Microphone:

1. Locate to provide typical 6" to 18" working distance between microphone and lecturer's mouth.

C. FM Wireless Microphone System:

1. Orient antennas as recommended by manufacturer. Locate in positions shown on drawings.
2. Antenna Cables: Use specified low-loss 6/U (75 ohm) or 8/U (50 ohm) cable, impedance as required.

3. Except for transmitter equipment, all equipment including preamps and active combiners requiring DC power provided with power supplies or powered by receivers (battery operation is not acceptable).
4. Do not mount antennas or attached preamplifiers directly to any metal structure. Mount at least 3 ft. from any large metal object.
5. Dual-Antenna Phase/Diversity System (Telex, Shure): Use 2 antennas, both vertically oriented, with one in each stage wing (min. 20 ft. apart).

D. Digital Wireless Microphone System:

1. Install remote antennas min. ½ wavelength in distance from each other (UHF frequencies).
2. Antenna Cables: Use specified low-loss 6/U (75 ohm) or 8/U (50 ohm) cable, impedance as required by manufacturer.
3. For systems with Digital Transceivers (access point), mount with face aimed at desired coverage area.
4. Do not obstruct the microphone/transceiver line of site.
5. Observe minimum separation between mounted access point/transceivers.
6. Use RF spectrum scanning utility where required for RFI (Radio Frequency Interference) conflicts.

3.06 AMPLIFIERS AND SIGNAL PROCESSORS

A. Gain Control Security:

1. Amplifiers and Signal Processing Equipment: Power amplifiers and signal processing equipment with front panel controls or power switches which are to be permanently adjusted (not normally adjusted by the operator), such as equalizers, distribution amplifiers, limiters, and audio delays, shall be furnished with lockout of front-panel controls, security panels, or be mounted on subpanel behind blank panels. Provide transparent plastic panels for viewing of indicators such as meters or LED indicators.

B. Audio DSP:

1. Install all equipment to manufacture specifications and industry standards.
2. Adjust the system gain and equalization to meet specifications. Adjust equalization curves as required for speech and program audio playback.
3. Record and store all DSP configuration files.
4. Test all functions of each piece of audio DSP equipment, including front panel and remote controlled functions.

C. Verify all loudspeakers are delayed and equalized properly.

3.07 LOUDSPEAKER EQUIPMENT

A. Loudspeakers:

1. Carefully inspect the site to verify that no obstructions, such as beams, panels, large framing members, etc. exist between loudspeakers and any seating area covered by the loudspeakers. Immediately notify Architect of any such obstructions.
2. Provide and install safety cable to secure all suspended components and mountings.
3. Provide all structure and framework as required to properly support the loudspeakers in the indicated locations. Provide shop drawings of proposed structure for review prior to fabrication. Obtain the stamp of a structural engineer registered in the same state as the construction site on shop drawings which depict loudspeaker cluster structure, framework and support system(s).

4. Paint all components and provide cloth grilles for loudspeaker enclosures as required by Architect.

B. Ceiling-mounted Loudspeaker Enclosures and Grilles:

1. Ceiling Enclosures: Enclosures supported directly from ceiling structure in an approved manner. Support directly by acoustical ceiling tile is NOT ACCEPTABLE.
2. Flush and Surface-Mounted Ceiling Enclosures: Provide enclosures as required and approved by Architect for areas as indicated on drawings.
3. Surface-Mounted Wall Enclosure: Located as indicated on drawings. Coordinate enclosure colors with the Owner.

3.08 ALS ANTENNAS

A. RF Assistive Listening System:

1. Orient external coaxial dipole antenna ground plane in proper direction.
2. Test all receivers with program material for noticeable dropouts in signal.
3. Test all bodypack receiver accessory headphones and neckloops.
4. Provide field strength data and commissioning report to AV consultant.

3.09 VIDEO EQUIPMENT

A. Video Projectors:

1. Verifications:

   a. Verify lens selection, locations, and elevations shown on drawings using manufacturer's throw distance and elevation formulas for specified projector model.

2. Submittals:

   a. Provide plan and section drawings verifying image width, lens-to-screen distances and mounting methods.
   b. Provide detailed drawings of custom-fabricated or stock mounts and hardware.
   c. Provide detailed drawings of millwork or finish items required for specified screen dimensions.
   d. Where mirrors are required, provide detailed drawings of mounting angles, reflection rays, support structures and hardware.
   e. Where projector mounts or motorized lifts are installed by others, all drawings must indicate installation positions allowing optimal projector performance.

3. Mounting:

   a. Install projector mount and suspend projector at location and elevation indicated on approved shop drawings.
   b. Projector mounts and motorized lifts must meet all applicable safety and code requirements for ceiling mounted equipment.
   c. Fixed projector mounts must be rigid and completely free of sway or rotation deviation.
   d. Projector support pipes shall be only fixed-length pipes as required—do not use adjustable-length pipes.
   e. For ceiling mounted installations where screen surfaces are vertical, level projector at 0° front-to-back and side-to-side.
   f. Position projector centered on screen centerline in plan unless projector is provided with horizontal lens shift capability. Do not employ vertical or horizontal electronic keystone correction unless specifically authorized to do so.

g. Wherever possible, minimize hardware and cables visible from audience seating and presenter area view points.
h. Paint exposed mounting hardware to match room interior or as instructed by Architect.
i. Where structural mounts or millwork openings are provided by others, verify correct positioning and dimensions before mounting projector. Provide written notification to the Owner or Architect of any discrepancies in mount positioning or stability deficiencies before projector installation.
j. Where rear projection screen millwork is provided by others, provide written notification to the Owner or Architect of any discrepancies opening dimensions before screen or projector installation.
k. Provide all necessary projector brackets, fittings, pipes, miscellaneous hardware and wireways.
l. Run cabling from video projector box to projector within projector support pipe.
m. Provide approved security cable for video projectors to accept padlock provided by owner.

B. Digital Media Transmission and Switching Systems:

1. Extended Display Identification Data (EDID):

a. Do not operate digital media transmission/switching equipment in “automatic EDID” mode, unless equipment provided has no other option.
b. Do not include resolutions in the EDID table that cannot be handled by display(s).
c. For systems where laptop computers will be used in “mirroring” mode, ensure that as many possible common resolutions are included in the EDID table without violating provision of preceding paragraph.
d. For inputs where the source is a fixed device (i.e. a fixed part of the system) create the EDID table with a single entry, again without violating provision of preceding paragraph but one.

2. HDCP Implementation:

a. For systems containing a non-HDCP-compliant display device, such as a class capture appliance or videoconference CODEC, and where switching equipment supports the capability, dynamically configure input devices for portable equipment such as laptops to report to the equipment as non-HDCP devices when the non-compliant device is in use.

3.10 CONTROL EQUIPMENT

A. Audiovisual Control System:

1. Do not mount wireless receiver gateways or antennas near large metal objects.
2. Carefully coordinate with manufacturer and with Architect the dimensions and mounting conditions of all items.
3. Provide all required cable, relays, and miscellaneous hardware to interface the audiovisual control system with the Auditorium preset lighting system, front projection screens, drape, and chalkboard.
4. Install all components so as to use the maximum amount of any tally signals provided by the controlled equipment, including lighting dimmer systems and video playback and recording devices.
5. Mount infrared LED emitter probes to face of controlled equipment using thin layer of clear silicone caulk. Position probe to provide control of device while continuing to allow use of infrared control supplied with equipment. Secure probe cables to prevent probe from being accidentally pulled from equipment during normal system operation.

B. Ethernet/IP/Local Area Network Accessibility and Control:

1. Coordinate Ethernet connectivity and IP addressing of control devices with Electrical Contractor and the Communications/Technology management of the facility. Owner will provide all required IP addresses to AV contractor.
2. Provide owner with remote control and management software interfacing via Local Area Network access from PC to any IP addressed control devices.
3. Coordinate with end-user and Communication/Technology management of the facility, on POP-3 email notification of system service issues where desired and /or where possible. Co-ordinate with Owner and Communications/Technology management of the facility on POP-3 email of service or security issues in case of failure or disconnection of any bi-directional (e.g. RS-232 or Cresnet/AXLINK) device.
4. Verify requirements of system control via IP with or Owner and Consultant.

C. Local Area Network Management Programming:

1. General:

   a. Verify requirements of room management/scheduling via IP with or Owner and Consultant.

2. Room AV system control:

   a. Use included software and Ethernet connectivity hardware of control systems.
   b. Program remote site portal to replicate appearance and function of control touch panel.
   c. Control program can be launched locally from designated AV technician computers as stand-alone ".exe" Windows-based executable file.

3. Remote System Status Monitoring and Management Programming:

   a. Use included software and Ethernet connectivity hardware of control systems.
   b. Provide system-wide and room-specific monitoring and management including:
   c. Room activity and system shut-down scheduling.
   d. Multiple user level password settings, including password change and lock-out of certain user passwords at certain times.

4. POP-3 Email Notification Programming and Set-up:

   a. Via included software and Ethernet connectivity hardware of control systems.

      1) Provide service issue notification via pre-programmed email messages to designated service accounts ONLY if requested by end-user AV support technicians and ONLY if control system includes POP-3 mail server.
      2) Coordinate with AV Consultant and Owner to determine proper conditions and destinations for email service.
      3) Provide notification of AV system service issues.

   b. Coordinate with Owner for communication between the AV control system and Owner-provided network-based asset management system (Crestron Fusion).

5. Audiovisual Control System Programming:

   a. All programming to be performed by programmer certified by the manufacturer of the AV control system equipment provided.
   b. Program system or instruct AV Control System Manufacturer to program system as instructed by the AV Consultant and the Owner, and as indicated

on the drawings so that all devices are controlled in a logical manner, and to take full benefit of the capabilities of the Control System.

c. Submit for approval changes to programming or control panels required by actual conditions (e.g. number of dimming system presets).
d. Refine and adjust, as required, programming to operate in a logical and consistent fashion. Make revisions to program as directed by the AV Consultant at checkout to correct operational inconsistencies or to properly control devices.
e. Ascertain that the system is optimally programmed for smooth transitions between media uses and for minimal wear-and-tear on equipment and audiovisual media.
f. Verify that video playback device transports, etc., are stopped when another input source is selected, unless playback device is routed to a different destination from the selected source.
g. Wherever possible, utilize status feedback of source equipment, dimming systems, etc., to indicate to the control system and user the actual operating mode of the equipment. When feedback is not available (e.g. consumer playback equipment) program control system to issue commands as required to minimize status reporting errors.
h. Provide color electronic drawing files of screen layouts of touchscreen control panels for approval prior to system programming.
i. Distinguish between primary and secondary control buttons by intensity or color. If available, use "3D" buttons to indicate button activation as visually "depressed". Avoid excessive use of primary or other bold colors.

6. Color Video Touch-Screen Control Panels:

a. Submit panel graphics (including text, buttons, colors, images, backgrounds etc.), as well as panel flips, sub-panels and overall screen logic flow to the Owner and Consultant for review and approval.
b. Use Crestron Studio® for panel logic programming and design; make software files available directly to the end user upon request, free of charge.
c. Join numbers (other than those reserved for panel logic), hardware programming and all other installation requirements including programming software and computers are the responsibility of the installing contractor.
d. Any adjustments, revisions, modifications, etc. to the panel graphics and control system required for complete operation are the responsibility of the installing contractor.

7. Master Control Panels:

a. Install local control panels in associated back-boxes, as required.
b. Verify size and mounting conditions with Owner.
c. Confirm operation of portable wireless panels, WAP access points, and Gateways.

D. Control System Functions:

1. Following are general descriptions and guidelines for control system panel functions and layouts:

a. Turn system on/off.
b. Input source selection.
c. Separate speech and program audio volume controls. Preset microphone and audio playback levels on startup.
d. Recovery from power outage.
e. Control digital signal processors to provide system presets indicated in this specification or on the AV drawings or others as required.
f. AC power failure and switchover to UPS.

g. Lighting presets (coordinate with lighting installer).
h. Others as identified elsewhere in the Contract Documents or required.
i. After system shut-down, AV system will restart with default settings restored.
j. Others as identified elsewhere in the Contract Documents or required.

2. Following are specific descriptions and guidelines for control system panel functions and layouts:

   a. Volume Control (provide separate microphone and program audio volume controls where applicable).
   b. Projection screen up/down.
   c. Transport controls for all applicable AV sources.
   d. Select which video input is actively displaying and playing audio through the AV system.
   e. Touch screen control panel screen sleep when inactive after a period of time. Disable touch screen proximity sensor on wall and rack-mounted control panels. Coordinate timeout requirements with Owner.
   f. Others as identified elsewhere in the Contract Documents or required.

3. Where applicable, configure the audiovisual control system(s) with the following operation(s):

   a. Control system shall communicate with video display devices (particularly video projector) during start-up and shut-down. Feedback shall be provided on the control panel indicating when the projector is cooling down, and inform the user that the projector cannot be restarted until cool-down is complete.
   b. Control system, audio signal processors, and digital video switch equipment will connect to the UPS where these devices are specified. Control system shall communicate with UPS device. In the event of a power outage, after one minute has passed, control system shall instruct the other UPS-connected devices to shut-down properly in order to protect their programming. After power is restored, user will be required to restart system from control panel.

4. Interface with Fire Alarm System: The audiovisual system shall connect to the FAS as identified on the drawings. Systems shall be muted when triggered by the FAS.

3.11 NETWORKED AV & SECURITY

A. All equipment to be configured to prevent unauthorized users from access to the systems and network and prevent disclosure of confidential information.
B. AV contractor to update all device firmware to the latest stable version.
C. Utilize all appropriate security features available for connected products, including but not limited to:

   1. AES encryption.
   2. 802.1x authentication.
   3. SSH, SFTP, or other secure protocols.

D. Provide a list of all network connected AV devices to the Owner. List to include a minimum of the following:

   1. Manufacturer.
   2. Model number.
   3. MAC address.
   4. Serial number
   5. IP address.
   6. Others, as required by the Owner.

E. Default passwords of internet connected audiovisual equipment are readily known and can be used as a means to access network equipment by unauthorized users. AV networked devices may include any device with a wireless or wired Ethernet port.

1. Assign role based access control with different levels of access and permissions for each user type:

   a. Admin - Ability to make changes to network, security configurations, and user accounts.
   b. AV Configuration - Ability to make changes to AV Parameters.
   c. System User - System operation only.
   d. Others as required by the Owner.

2. Change all passwords from default values to project specific passwords. Follow industry recommended password strength standards when choosing new passwords.
3. Provide new passwords to the Owner.
4. Provide instructions to change passwords.

F. AV Network Switches:

1. Do not connect unauthorized AV network switches to the Owner's LAN.
2. Provide logical separation of AV and IT networks through hardware and VLAN's.
3. Disable unoccupied ports and services on managed switches.

3.12 PROJECTION SCREENS

A. General: Install projection screens at locations indicated to comply with screen manufacturer's written instructions.
B. Install front-projection screens with screen cases in position and relationship to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.
C. Test electrically operated units to verify that screen, controls, limit switches, closure, and other operating components are in optimum functioning condition.
D. Protect projection screens after installation from damage during construction. If damage occurs despite such protection, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

3.13 RACKS, CABLES, CONNECTORS, AND MISCELLANEOUS EQUIPMENT

A. Wiring and Interconnections:

1. General:

   a. Exercise care in wiring to avoid damage to cables and equipment.
   b. Make all joints and connections with rosin-core solder or approved mechanical connectors, except mechanical connectors are NOT acceptable on microphone lines. Connections to transformer leads for distributed loudspeakers may be made using properly-sized wire nuts or nylon-insulated pigtail crimp connectors such as Waldom CE series. Wire nuts are not acceptable except at individual loudspeakers.
   c. All connections to screw-type terminals shall be made using spade lugs. Bare or tinned wire is not acceptable.
   d. All connections to lugless compression-type screw terminals shall be made using bare wire only. Do not tin wire.
   e. All wiring executed in strict adherence to standard broadcast practices. This includes:

1) Dress cables in conveniently sized bundles, combed into parallel runs, either laced or banded with sufficient plastic ties.
2) For equipment mounted on glides, or otherwise requiring servicing from the front of the rack incorporate a cable "service loop" of sufficient length to permit the equipment to be pulled forward from the rack for servicing.
3) Support cables and bundles with sufficient plastic ties and support bars to ensure that no strain is placed on any connections or connectors.
4) Organize cables and cable bundles behind patch bays to permit easy access to the patch panels to add or remove cables.
5) Place cable markers 3"-5" back from video connectors to permit easy viewing. Do not bind markers into cable bundles.

f. All audio signal lines carried by twisted-pair cable and switched with two poles per line unless noted otherwise. Do not tie one side of audio line to other audio lines.

2. Grounding:

a. Ground equipment, racks, and audio line shields to independent audio system ground ONLY as shown on drawings. If not shown on drawings, ground case of power striplines in equipment racks to the racks and directly to isolated ground buss in the power panel or to power system ground at the building AC service entry only.
b. Ground all conduits ONLY to power system ground. Insulate all conduits and electrical boxes from sound system, including equipment racks and audio system ground.
c. Insulate all conductors in conduit, including shields, from the conduit, back boxes, and from each other for the entire conduit length.

3. Equipment Racks:

a. Install equipment in racks to permit access to all equipment for service. Transformers, relays, terminal blocks, etc., mounted in rear of racks behind other equipment shall not prevent access to equipment connections or shall be mounted on hinged panels to permit access.
b. Wire all racks completely in the shop. No internal rack wiring to be done on the job site.
c. Install equipment in racks with ventilating panels as required to provide adequate ventilation and according to equipment manufacturer's recommendations.
d. Provide unused panel space with blank or ventilating panels.
e. Locate patch panels at least 30" above floor.
f. Locate free-standing racks as indicated and to provide access to rear without moving racks.
g. For permanently located racks containing equipment on glides, with desk/control surfaces, or which may be unsteady from cantilevered devices or personnel, bolt all racks to the concrete floor slab (through the access flooring if necessary).
h. Bolt adjacent racks together on at least 3 locations along both the front and rear edges.
i. Equip racks not bolted to the floor because of service access with "Anti-tip" bases, casters and brake.

4. Conduit:

a. Run lines in metallic conduit or wireways unless otherwise indicated. Run microphone level, line level, loudspeaker level, and DC control wiring each in separate conduit.

b. Do not locate AC power lines in conduit containing network, audio or video lines.
c. Do not splice lines in conduit.

5. Exposed Cables:

   a. Line level or mic level lines exposed above countertops (such as those lines serving mixing consoles, program source equipment, etc.) shall be rubber-jacketed, AWG #20 two conductor with braided shield such as Belden 8412 or equivalent. Plastic or vinyl jacketed cables are not acceptable.

6. Receptacles:

   a. Wall-mounted receptacles in metal boxes at building standard receptacle height unless otherwise indicated.
   b. Floor-mounted receptacles in flush floor boxes with flush lids.
   c. Catwalk-mounted receptacles in metal boxes mounted on catwalk hangers at building standard receptacle height.

7. Balanced Receptacles:

   a. Attach "XLR" type connectors to mounting plates with machine screws unless using single-hole mounting types with threaded sleeve and mounting index to prevent rotation.

8. Unbalanced Receptacles:

   a. Install 1/4" phone jacks to mounting plates with insulating washer and sleeve to electrically isolate the jack from the electrical box and conduit.
   b. Install isolation/balancing transformers in electrical boxes or wireways adjacent to each unbalanced receptacle as indicated.
   c. Wire input receptacles to short the line except with connector inserted.
   d. Video Receptacles: Install feed-through BNC receptacles to mounting plates with insulating washer and sleeve to electrically isolate the receptacle from the electrical box and conduit.

9. Loudspeaker Wiring:

   a. Note that Functional Diagrams or Conduit Drawings indicate required home runs for loudspeakers and loudspeaker zones. Home run requirements depend on line power loss as well as functional considerations and shall be strictly adhered to.
   b. Loudspeaker lines above ceilings installed using specified UL listed plenum-rated cable. Lines installed as high as possible, directly to undersides of floor or to roof decks above, using strain reliefs, cable ties, or other approved method to attach lines securely and neatly to building structure. Lines installed loosely or otherwise on top of ceiling tiles, ductwork, etc., are NOT ACCEPTABLE.
   c. Floor-to-floor lines installed using specified UL listed plenum-rated cable. Attach lines securely and neatly to building structure using Owner-approved method.

10. Fiber Optic Cables:

   a. Terminate fiber optic strands with connectors compatible with connectors on equipment and with fiber optic cables provided.
   b. Use of compatible quick-connection system is recommended (e.g. Corning UniCam® Pretium Installation Tool Kit for Corning fiber cable; Belden FiberExpress System or West Penn Wire Fiber products with Optimax Installation Tool Kit).

c. Neatly coil surplus fiber cable using bend radius larger than manufacturer's minimum bend radius and secure to rack to prevent crimping or damage to cable, or provide rack-mount fiber management.

3.14 SYSTEM PERFORMANCE TESTS AND ADJUSTMENTS

A. Test all equipment to verify conformance with manufacturer's performance specifications and with this specification.

1. Verify all systems meet the requirements identified in this section or otherwise within the contract.
2. Adjust all systems as required to conform with testing requirements for any failed tests.
3. Provide results of final, re-calibrated system testing to Architect and AV Consultant for review and approval prior to scheduling of commissioning testing by AV Consultant or any user training provided to Owner.

B. Audio Systems:

1. Absolute Impedance:

a. Set any loudspeaker level controls at zero attenuation. Measure absolute impedance value of each loudspeaker line at 250, l000, and 4000 Hz, without amplifier connected but with all loudspeakers connected. Impedance shall be at least 90% of rated load impedance of respective amplifier. Check resistance of lines to all loudspeaker and microphone receptacles, with receptacles open and short circuited.

2. Hum and Noise Level:

a. Adjust gain controls for optimum signal-to-noise ratio and full amplifier output with -55 dBm level at a microphone input and 0 dBm at line-level input.
b. Without changing gain, terminate microphone and line-level inputs with shielded resistors of l50 and 600 ohms, respectively.
c. Measure overall hum and noise level at each power amplifier output for each input channel. Level shall be at least 80 dB below rated power output of amplifier over a bandwidth of 20-20,000 Hz.

3. Electrical Distortion:

a. Load power amplifiers with resistors matching nominal impedance of output terminals used in system in place of actual loudspeaker loads.
b. Adjust gain controls as for hum and noise level tests.
c. Apply 1000 Hz size-wave signal from an oscillator having less than 0.l% total harmonic distortion to each microphone and line-level input at level required to produce measured full amplifier output.
d. Distortion shall measure less than 0.l%.

4. Parasitic Oscillation and RF Pickup:

a. Set up system for each specified mode of operation.
b. Use 50 - 100 MHz bandwidth oscilloscope and loudspeaker monitoring.
c. Check to ensure that system is free of spurious oscillation and RF pickup in the absence of any input signal and also with system driven momentarily to full output at 60 Hz.

5. Buzzes, Rattles, Distortion:

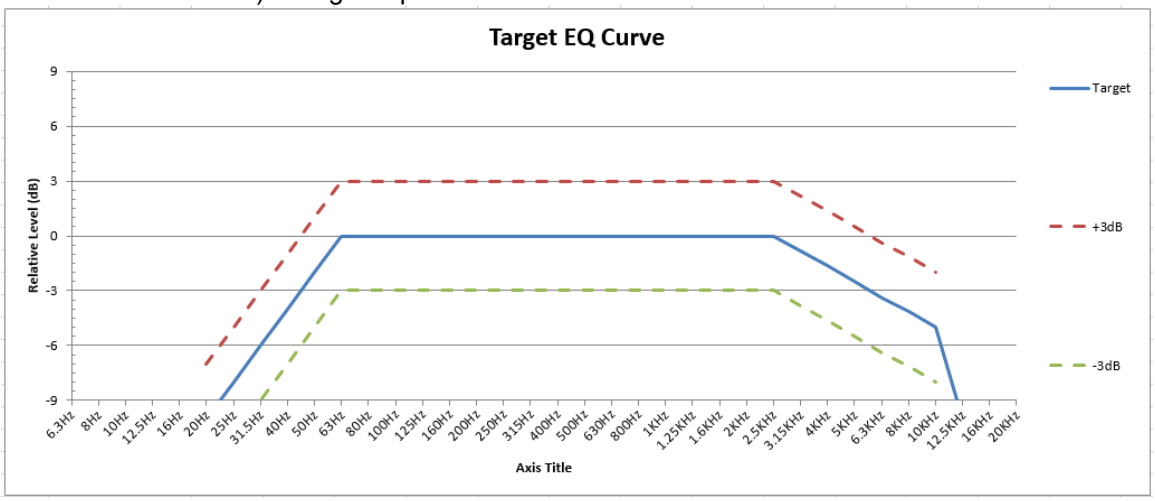
a. Apply high-quality music signal to the system. Adjust the system for frequent peaks at its specified maximum sound pressure level.
b. Apply sine-wave sweep from 50-50,000 Hz at 6 dB below full amplifier power.

c. In both cases, listen carefully for buzzes, rattles, and objectionable distortion.
d. Correct all causes of such defects. If cause is outside the system, promptly notify the Architect and his Consultant, indicating cause and suggested corrective procedures.

6. Level Balance: Adjust level controls for all items of similar equipment for identical measured voltage gain.
7. Measure system acoustical performance using a sound level meter set for "slow" meter damping except as otherwise noted, and flat response with random incidence at a height of 4 to 5 feet. All interior finishes and furnishings shall be in place, and system gain shall be adjusted to provide levels of 70 to 80 dB and at least l0 dB above background noise at the measuring locations for these tests, except as otherwise noted. Include the following tests and adjustments:

   a. Frequency Response:

      1) Measure loudspeaker frequency response with all control equalization set for flat response, using l/3-octave bands of filtered pink noise centered on ANSI preferred frequencies, or broadband calibrated pink noise measured in l/3-octave bands using a calibrated real-time analyzer.
      2) Adjust equalization to provide average system response within ± 3 dB of a response (0 dB) which is flat from 63-2500 Hz and slopes uniformly from 0 dB at 2500 Hz to -5 dB at 10,000 Hz.
      3) Target Equalization Curve:



      4) Provide frequency response measurements in graphical format with third-octave band frequencies on the X-axis, and sound pressure level (SPL, unweighted) on the Y-axis.

   b. Uniformity of Coverage:

      1) Use 4000 Hz octave band of random noise as test signal output to loudspeakers.
      2) Lateral Uniformity: ± 2 dB at all positions equidistant from front of hall.
      3) Front-to-Back Uniformity: Decreasing linearly within ± 2 dB from 0 dB at front of hall to -6 dB at rear as measured on the hall center line.

   c. Maximum Output Level:

      1) Measure with standard "fast" meter damping.

2) Loudspeaker Cluster: Capable of providing 95 dB SPL in the audience area on axis of any high-frequency horn and employing wideband recorded music as a test signal.
3) Distributed Loudspeaker Systems: Capable of providing 95 dB SPL on axis of any loudspeaker and using wideband recorded music as a test signal.

d. Speaker Polarity:

1) Using a NTI Minirator MR-PRO, use the generator Sawtooth (WAV) pattern to check the polarity of each program loudspeaker. When the speaker polarity is normal the measuring meeting will display POSITIVE.
2) Correct the polarity of any speaker out of phase.
3) Record results.

C. Video Systems: Test the video system following the approved Proof-of-Performance Test Plan to verify that it meets these minimum performance requirements.

1. Video Standards:

a. Frequency Response: ± 0.5 dB, 60 to 4.l8 MHz.
b. Crosstalk: -40 dB at 3.58 MHz.
c. S/N Ratio: 45 dB, DC to 4.l8 MHz, unweighted, peak to RMS.
d. Hum: <10 mV peak to peak.
e. Line and Field Tilt: 2% with 60 Hz square wave.
f. Differential Gain: 1% at 3.58 MHz, l0-90% APL.
g. Differential Phase: ± 1° at 3.58 MHz, l0-90% APL.
h. Envelope Delay: ± 0.l microseconds, 0.2 to 2.1 MHz; ± 0.05 microseconds at 3.58 MHz.
i. Color Production: Primary and Complementary Colors (R, G, B, Cy, Yl, Mg) at 75% saturation within inner 50% of the of inner boxes (± 2.5°) when viewed on vectorscope.
j. Signal Levels: 1 V p-p, ± l IRE, at 100% peak white color bar.

2. Audio Standards:

a. Frequency Response: ± l dB, 30-l5,000 Hz.
b. Hum and Noise: -80 dBu, 30-l5,000 Hz, unweighted.
c. Distortion: 0.25% THD, 30-l5,000 Hz.
d. Signal Levels: +4dBu.

D. Video Display Systems: Calibrate each video display system as follows:

1. For projected displays align the image with the black borders of the screen:

a. If the display uses a variety of aspect ratios use the zoom lens to align the image with the black borders of the screen. If the image does not fill the screen (e.g. a 16:9 screen with 4:3 image) then align top and bottom of image with black border of screen.

2. Allow projector or flat panel display to warm up for a minimum of 30 minutes.
3. Turn off all video enhancement circuitry options including image overscan.
4. Set factory color temperature to warm, D65, or other setting to achieve closest approximation to 6500°L color temperature. Set sharpness control to minimum.
5. Adjust black level and video gain:

a. Reduce ambient light to less than 2 foot-candles of ambient light on screen.
b. Using the PLUGE (Picture Lineup Generating Equipment) pattern from the signal generator, adjust the brightness (brightness control on most displays) until the “blacker-than-black” bar is visible on the screen and then decrease brightness until the bar just disappears.

c. Using the grayscale pattern from the signal generator, adjust the contrast control so that the highest grayscale transition disappears and then decrease contrast to make the transition just visible..
d. Repeat steps b and c as required for stabile results. Record control settings.

6. Adjust color level or gain:

a. Display SMPTE color bar test pattern. Shut off red and green channels on display or use a blue filter to observe the display.
b. Adjust color and tint controls for optimum blue balance.
c. With only red channel operating or with red filter check red balance. Repeat for green channel. If red and/or green balance is significantly out of balance, make minor changes to color and tint controls to achieve best compromise for color control settings.
d. Record control settings.

7. Adjust sharpness:

a. Using the S802B or similar pattern, adjust sharpness control for maximum sharpness without ringing (duplicate lines).
b. Record control setting.

8. Brightness, Uniformity, and Contrast Ratio:

a. Using the ANSI 9-zone pattern and a spot meter, measure screen brightness in each zone. Calculate screen brightness as the average of the nine zones and uniformity as the maximum variation from the average.
b. Using the ANSI 12-zone checkerboard pattern measure the contrast ratio of representative white squares vs. adjacent black squares. Repeat contrast measurement with room lighting at representative viewing level (typically 7fc in seating area).
c. Record measurements.

9. For display systems employing identical equipment (same model number), measure and adjust two representative samples as specified above. If control settings for both displays are in close agreement, controls of remaining identical displays may be set to same values without further testing, unless resulting performance is visibly different from the first two.

E. Digital Video Systems: Provide the following information for systems employing HDMI and/or digital media signals:

1. The video timing (e.g. 1080p 30 fps Deep Color or 1366x768 30 Hz), HDCP use, and audio format of each non-portable digital source when operating.
2. The video timings and supported audio formats for each connected sink.
3. The video timings and supported audio formats presented in the EDID of sinks to each source – indicate the preferred video timing.
4. The length of cable used on all HDMI or shielded twisted pair cables used for AV distribution.
5. The data rate supported by each shielded twisted pair cable used for AV distribution.

F. Video Projectors:

1. Provide written verification of completion of the above procedures.
2. Provide a printed table of memory location mapping. Include memory number, name, resolution, vertical and horizontal scan rate.
3. Download memory map set-up data to personal computer and provide backup diskette to owner.
4. After completion of projector set-up and memory mapping procedures, record the following items for inclusion in pre-acceptance test reports:

a. Current lamp life hours shown on projector (include date).
b. Provide security service code if required by Owner.
c. Set-up software version number.
d. Projector, input module, decoder card and automatic-convergence unit serial numbers for each system.
e. Date of manufacture.
f. Date of installation.
g. List of supplied accessories (remotes, lens caps, tools, cables, backup discs, owner's manuals).

G. Remote Control Systems: Test each function of each control station to verify proper operation and that each illuminated switch and indicator operates properly when the associated function is selected.
H. Test Reports and Certificates: Submit results of all tests and adjustments conducted above and certification that the installation is complete and ready for checkout as specified under SUBMITTALS in PART I - GENERAL.

3.15 FINAL ADJUSTMENTS AND ACCEPTANCE TESTS

A. Upon approval of the contractor's test report, and at a time set by the Architect, assist the Consultant(s) in performing final system adjustments and acceptance tests. Provide all labor, material, tools, and measurement equipment necessary for these tests and adjustments, including the test equipment and material specified in Article 1.1, except as otherwise specified.
B. The contractor shall supply sufficient representatives for assisting in performance of these tests, all of which shall be thoroughly familiar with all details of the system, and shall include the field supervisor in overall charge during the course of the installation work.
C. Budget 8 working hours for the performance of these tests and adjustments. If final acceptance is delayed beyond this period because of installation not in accordance with these specifications, pay for all additional time and expenses of Consultant(s) during any resultant extension of the acceptance testing period.
D. Acceptance tests may include speech intelligibility surveys and subjective evaluations by observers listening at various positions under various operating conditions, using speech, music, and live or recorded effects material.
E. Measurement of frequency response, distortion, noise, or other characteristics may be performed on any item or group of items deemed necessary to determine conformity with specifications.
F. Adjustments: Adjust the system as instructed by the Consultant. Adjustments may be required to any portion of the system including:

1. High-frequency horn aiming.
2. Loudspeaker digital beam steering.
3. Equalization and level balance.
4. Timing and functioning of the audiovisual control system.
5. Video projector alignment, contrast, brightness, and color content.

END OF SECTION

SECTION 31 20 00 - EARTHWORK

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division I Specification Sections, apply to the work of this Section.

B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

C. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

A. Work Included: Work to be done under this Section includes, but is not limited to, providing all labor, materials, equipment and services as necessary and incidental to the proper execution of the work as shown on the Drawings and as specified herein.

1. Excavate all materials to limits indicated or required, including soil, utilities, remains of former structures, pavements, curbs, other materials and obstructions as necessary for foundations and below-grade construction, and other site improvements indicated on the Drawings and in the Documents.
2. Excavate trenches for utilities, utility relocations, and appurtenant structures indicated on the Drawings.
3. The Contractor shall be responsible for all earthwork activities, including excavating, handling, stockpiling, rehandling, etc. associated with reusing all soil materials on site.
4. Coordinate excavation and backfilling such that all excavated material is reused on site. The only material permitted to be disposed off site is ABC debris.
5. Furnish all labor, materials and equipment to install and remove all excavation support systems required for the Work. All excavation support systems shall be designed by the Contractor. Pre-excavate as required for installation of such systems.
6. Demolish and remove existing structures or portions thereof to allow new construction.
7. Furnish from approved borrow source(s) fill or backfill materials for placement and compaction on-site as required to complete the work of this Section. Provide specified materials from off-site sources as required.
8. Remove and dispose of all below grade obstructions including buried foundations, slabs, foundation walls, and other existing debris.
9. Prepare and protect subgrades as indicated on the Drawings and as specified.
10. Protect subgrade from freezing temperatures before and after concrete footings or other improvements are placed.
11. Grading, shaping and compacting subgrades.
12. Provide dust control during all Earthwork activities to eliminate dust in the air.
13. Contractor shall protect all utilities.
14. Conduct all required dewatering. Contractor shall dig trenches/pits adjacent to dewatering area to recharge all water. No permits have been obtained for discharging into the storm or sewer drain.

1.3 DEFINITIONS AND REFERENCE STANDARDS

A. The Owner's Representative, or their authorized representative, is the authorized representative of the Owner for Work covered by this Section.

B. Contractor: The Contractor is the person or organization identified in the Agreement as being responsible for the Work under this Section. The term Contractor shall also refer to an authorized representative of the Contractor.

C. ASTM: Specifications of the American Society for Testing and Materials.

D. AWS D1.1 Structural Welding Code - Standard Code for Welding in Building construction, of the American Welding Society.

E. AISC: Specification of the American Institute of Steel Construction.

F. ACI: American Concrete Institute.

G. Code: Current Edition of the Massachusetts State Building Code.

1.4 SITE CONDITIONS

A. Numerous underground utilities are known to exist at the site.

1.5 QUALITY ASSURANCE

A. Comply with all rules, regulations, laws and ordinances of the Commonwealth of Massachusetts, Town of Stow, and all other authorities having jurisdiction. All labor, materials, equipment and services necessary to make work comply with such requirements shall be provided without additional cost to Owner.

B. The Contractor shall protect adjacent property, public utilities and structures, and completed work, from damage associated with the Work of this Section. Damage due to the Work of this Section shall be repaired by the Contractor at no additional cost to the Owner.

C. All backfilling and compaction activities shall be conducted under the observation of the Owner's Representative.

D. Testing and Monitoring: The Contractor's quality control of earthwork operations may be monitored by the Owner's Representative. The Contractor shall provide sufficient notice to the Owner's Representative prior to the work and shall cooperate with the Owner's Representative in all respects to facilitate any testing or observations required. The Owner's Representative will make such tests as are deemed necessary to determine compliance with these Specifications.

E. All fill materials and their placement will be subject to quality control testing. The Contractor will bear the cost incurred by the Owner of any and all tests which are needed to correct previously unacceptable work. Test results and laboratory recommendations will be available to the Contractor.

F. Tolerances

1. Construct finished soil and backfill surfaces to plus or minus ½-inch of the elevations indicated.
2. Maintain moisture content of fill material as it is being placed within plus or minus two percent of the optimum moisture content of the material as determined by the laboratory tests specified herein.
3. Compaction of backfill shall be at least to the percentage indicated in this Section.

1.6 LINES AND GRADES

A. Lay out all lines and grade work not presently established at the site in accordance with Drawings and Specifications. Survey control shall be established by a Registered Land Surveyor or Professional Civil Engineer. Maintain all established bounds and bench marks and replace as directed any which are destroyed or disturbed.

B. The words "finished grades" as used herein shall mean the required final grade elevations indicated on the Drawings. Spot elevations shall govern over proposed contours.

1.7 SUBMITTALS

A. The Contractor shall submit the information specified herein to the Owner's Representative for review. Unless otherwise specified, submittals shall be made not less than three weeks before the start of work.

B. These submittals shall be reviewed and acceptable to the Owner's Representative prior to conducting any work. The Contractor shall forward submittals in advance considering that re-submittals may be required prior to acceptance.

C. Submit the following:
1. Specifics of proposed excavation and compaction equipment, including description, manufacturer's literature and specifications.
2. A detailed plan and written description showing proposed schedule and sequence of excavation.
3. For each type of material to be used as fill or backfill, the Contractor shall provide the Owner's Representative with two fifty-pound bag samples from each proposed source of material a minimum of two weeks prior to first use. Each sample shall be clearly labeled as to source of material, proposed use and date of delivery.
4. The Owner's Representative may select one, one-hundred lb bag sample of each type of material from a single source for each 500 cubic yards placed or otherwise sample as deemed necessary, at time of placement.
5. Copies of applicable permits.
6. Excavation Support Designs.
7. Means and methods of dewatering and size and location of proposed recharge pits.

D. Site Characterization of All Off-site Borrow Sources: The following information shall be submitted to the Owner's Representative for review prior to use of an off-site borrow source. No soil materials shall be brought to the site without approval by the Owner's Representative.

1. Site Data: Information regarding the off-site borrow source and material, as follows:
   a. Location of the borrow source site;
   b. Present and past usage of the source site and material;
   c. All previously existing report(s) associated with an assessment of the source site as relates to the presence of oil or hazardous materials; and
   d. Total Petroleum Hydrocarbons (Infrared Method) per 500 c.y. (EPA 9071/418.1).

E. Quality Control Testing for Off-site Borrow Materials:

1. In the event that site characterization of off-site borrow sources indicates that soils are acceptable to the Owner's Representative for use, then chemical testing will <u>not</u> be required. It is anticipated that chemical testing would <u>not</u> normally be required for material from customarily utilized commercial borrow sources.
2. If the materials are suspected of being contaminated based on review of the site characterization data, chemical testing will be required as directed by the Owner's Representative. The chemical testing shall be completed by the Contractor at no additional cost to the Owner.
3. Chemical Test Data: Each material source requiring chemical testing shall be sampled by a person experienced in sample collection who is a professional engineer registered in the Commonwealth of Massachusetts, registered professional geologist, certified groundwater or environmental professional, or duly authorized representative thereof.

   Samples of each material shall be submitted to a chemical analytical laboratory, certified by the Massachusetts Department of Environmental Protection, for the following analyses:
   a. Volatile Organic Compounds, (EPA 8240 plus Hazardous Substance List (HSL) Parameters);
   b. Acid and Base Neutral Extractable Organic Compounds, (EPA 8270);
   c. Pesticides/PCBs (EPA 8080);
   d. Total Petroleum Hydrocarbons (Infrared Method) (EPA 9071/418.1);
   e. Thirteen Priority Pollutant Metals (EPA 7000 Series);
   f. Total Cyanide (EPA 9010); and
   g. Total Phenols (EPA 9065).
4. Soil samples shall be obtained and tested in accordance with criteria established by the Owner's Representative, and results submitted for review prior to use on site.

1.8 EXCAVATION REQUIREMENTS AND RESTRICTIONS

A. All work shall comply with all rules, regulations, laws and ordinances of the Commonwealth of Massachusetts, Town of Stow, EPA, DEP, OSHA, and all other authorities having jurisdiction.

B. The Contractor shall conduct operations to interfere as little as possible with the use ordinarily made of roads, sidewalks, and other facilities.

1.9 TEMPORARY EXCAVATION SUPPORT

A. The Contractor shall be responsible for design and construction of all necessary excavation support systems. All support systems shall be removed after the work is completed.

B. Temporary earth support systems and open-cut excavations shall be designed in accordance with all applicable local, state and OSHA regulations by a Registered Professional Engineer in the Commonwealth of Massachusetts.

1.10 UTILITY CLEARANCE AND PERMITS

A. It shall be the responsibility of the Contractor to obtain required permits, licenses, and certificates from all authorities having jurisdiction over this work. Copies of these permits shall be submitted for review prior to the commencement of work.

B. It is the responsibility of the Contractor to identify all active utilities in the vicinity of the construction. Utilities in adjacent ground and/or servicing structures in the vicinity of the work shall be maintained at all times during construction. Active utility lines damaged in the course of construction operations shall be repaired or replaced immediately at no cost to the Owner.

C. Should uncharted piping or other utilities be encountered during excavation, consult the Architect and the utility owner immediately. Cooperate with the Architect and the utility owners in keeping services and facilities in operation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Compacted Structural Fill (Granular Fill): Material for compacted structural fill shall consist of clean gravelly sand or sandy gravel free of organic material, loam, trash, snow, ice, frozen soil or other objectionable material. This off-site material should be well graded within the following limits:

Sieve Size	Percent Finer by Weight
6 inch	100
No. 4	30 - 90
No. 40	10 - 50
No. 200	0 - 5

B. Compacted Common Fill (Ordinary Fill): Compacted common fill shall consist of mineral soil free from organic materials, loam, wood, ice, cinders, asphalt, concrete, trash and other objectionable materials.

Common fill shall not contain stones larger than six (6) inches in largest diameter and shall have a maximum of 80 percent passing the No. 40 sieve and a maximum of 30 percent passing the No. 200 sieve. It should not contain broken concrete, masonry rubble or other similar materials and shall have physical properties such that it can be readily spread and compacted during filling. Snow, ice and frozen soil shall not be permitted.

C. Processed Gravel: Sound, durable bank or crusher-run gravel and sand, practically free from loam, peat, and clay, well graded as follows:

Sieve Size	Percent Finer by Weight
3 inch	100
1 ½ inch	70 - 100
¾ inch	50 - 85
No. 4	30 - 60
No. 200	0 - 5

D. Crushed Stone or Drainage Fill: Double-washed, hard, durable stone free from loam, sand and clay, surface coatings, and deleterious materials. Stone shall be rounded in shape and conform to the following requirements:

Sieve Size	Percent Finer by Weight
1-1/2-inch	100
3/4 inch	5 - 70
3/8 inch	0 - 20

E. Pipe Bedding Material: Pipe Bedding Material shall consist of structural fill.

F. Geotextile: Geotextile shall consist of an approved non-woven geotextile filter fabric such as:
- Mirafi 140N
- US Fabrics 120NW,
- Contech Construction Products C-45NW
- approved equivalent.

G. Lean Concrete: Lean concrete shall have a minimum 28-day compressive strength of f'_c = 1,000 psi, unless otherwise noted.

H. Concrete: Concrete for mudmats shall have a minimum 28-day compressive strength of f'_c = 3,000 psi, unless otherwise noted.

I. Flowable Fill: Flowable fill shall consist of a mixture of sand and gravel with fly ash and cement a minimum compressive strength of 500 psi, unless otherwise noted.

2.2 EQUIPMENT

A. Compaction equipment shall consist of power-driven mechanical tampers and rollers as approved by the Owner's Representative and in confined areas, hand-guided vibratory equipment.

PART 3 - EXECUTION

3.1 INSPECTION OF THE SITE BY CONTRACTOR

A. Examine the site and all work prepared by others and report to the Owner in writing any conditions detrimental to the proper and timely completion of the work of this Section. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

3.2 GENERAL REQUIREMENTS

A. Excavation, backfilling and all earthwork activities shall conform with the Contract Documents and submittals that are acceptable to the Owner's Representative. No work shall be performed unless it is conducted under the observation of the Owner's Representative.

B. Maintenance of Excavations and Slopes
   1. Stability of excavations and job safety are the sole responsibility of the Contractor.
   2. Maintain soil slopes outside and inside the excavation. Promptly repair slides, slipouts, washouts, settlements, and subsidences which occur for any reason, and refinish the slope or embankment to the original lines and grades or as required by the Owner’s Representative.
   3. Shoring and bracing of trenches and other excavations shall be in accordance with the requirements of the Department of Labor Occupational Safety and Health Administration (OSHA) Document 29 CFR Part 1926 dated 31 October 1989.

C. Prevent erosion of open cut slopes and berms at all times.

D. All excavated material shall be reused on site. Contractor shall legally dispose of all ABC material leaving the site at no additional cost. Contractor shall notify Owner if contaminated soil or groundwater is encountered.

E. Concrete for foundations or slabs shall not be placed on frozen soil.

F. Reclaim all existing asphalt and gravel subbase for reuse as pavement subbase for new asphalt pavement areas. Separately stockpile and cover reclaimed asphalt and gravel subbase, protect pile from all moisture.

G. All excavated soils shall be reused on site. Excess material shall be legally removed and disposed of by the contractor. Contractor shall stockpile all excavated soils for reuse. Contractor shall screen all soils prior to reuse, if required to remove debris such as asphalt, bricks, wood, cobbles greater than 2-inches in size or other materials that will detrimentally effect the planned improvements. All stockpiles shall be protected against moisture and shall be covered to prevent any dust or wind blown dirt.

3.3 EXCAVATION

A. Requirements:
   1. Excavate to the lines and grades indicated, and no deeper.
   2. Excavate and backfill using appropriate methods and equipment in sufficient quantity, models and sizes to perform the work in the minimum time possible.
   3. Coordinate the sequence of excavation with all construction activities, specifically those activities conducted by the Owner's Representative in connection with the soil materials management plan.
   4. Prevent disturbance to all soil subgrades. Use smooth edged buckets as necessary to prevent disturbance. Remove unsuitable soil from excavation bottom as directed by the Owner's Representative.
   5. Remove excavated material from the excavation promptly. Do not stockpile excavated or off-site material immediately next to excavations.
   6. Exercise care to preserve the material below and beyond the lines of all excavations. Where excavation is carried below required grade, backfill to the structure subgrade according to methods and materials approved by the Owner's Representative.

B. When excavation has reached required subgrade elevations, notify the Owner's Representative who will observe the excavation conditions. After review by the Owner's Representative, the excavation may be required to proceed deeper due to Contractor disturbance of the subgrade, or variation in subsurface conditions.

C. Excavate trenches to the depth indicated or required. Carry the depth of trenches for piping to establish the indicated flow lines and invert elevations.

3.4 OVER-EXCAVATION AND BACKFILL BELOW NEW FOUNDATIONS

A. Contractor shall remove all fill in the footprint area of proposed structures and entrance and egress ways. Contractor shall excavate and remove all fill soils within the zone of influence of the proposed building foundations.

B. Contractor shall place and compact backfill acceptable to the Owner’s Representative in 12-inch-thick lifts. All backfill shall be compacted to 95% maximum dry density (Modified Proctor). Contractor shall place and compact Structural Fill within the zone of influence of all footings.

C. All of this work shall be conducted under the observation of the Owner's Representative.

3.5 SUBGRADE, SUBGRADE PREPARATION AND PROTECTION

A. General:
   1. Complete the excavations to the required subgrade.
   2. All subgrades must be observed and accepted by the Owner or Owner's Representative.
   3. Protect the existing structures from damage during subgrade preparation.

B. Cold Weather Subgrade Protection:
   1. When the atmospheric temperature is less than 32 degrees F, the Contractor shall protect excavation subgrades and concrete from freezing. Cold weather subgrade protection may consist of an earth fill cover, hay cover, insulation cover, heating or other means of protecting the subgrade materials from freezing.

C. Parking Lots / Asphalt Paving:
   1. Proof roll subgrade with machine driven heavy roller. Excavate any hard or soft spots revealed during proof rolling to provide consistent subgrade.

3.6 BACKFILLING

A. General:
   1. Backfilling activities, including placement and compaction, shall not be performed when air temperatures are at or below 32 F unless otherwise approved by the Owner’s Representative. In all cases, the soil being placed shall not be frozen and/or the backfill soil shall not be placed on frozen ground.
   2. Backfill materials shall not be frozen when placed or be allowed to freeze prior to or after compaction, placement, or curing. At the end of each day's work during freezing weather, the last lift of fill, after compaction, shall be rolled by a smooth-wheeled roller to eliminate ridges of uncompacted soil.
   3. Backfill excavations as promptly as work permits, but not until the subgrade, or below grade construction, is acceptable to the Owner's Representative.

4. Previously placed, and possibly accepted, backfill shall be excavated and replaced at no additional cost if the backfill does not conform to the Contract Documents.
5. Backfill behind all retaining walls shall consist of free draining, structural fill unless otherwise approved by the Owner’s Representative.

B. Backfill Materials:
1. All backfill materials brought to the site must be obtained from an Owner-approved borrow source(s).

C. Asphalt Pavement Areas:
1. After existing asphalt and pavement subbase is removed, the excavation surface shall be proof rolled. After the proof rolled surface is determined to be acceptable by Owner’s Representative, place and compact on site excess on site materials in 12-inch-thick lifts to pavement subgrade elevation.

D. Placement, Compaction and Protection:
1. All backfill material shall be placed "in-the-dry" on subgrades acceptable to the Owner's Representative. The Contractor shall dewater excavated areas as required to perform the work in such a manner as to preserve the undisturbed state of the approved subgrade material.
2. Structural Fill:
   a. Place structural fill materials in layers not exceeding 9 in. in depth measured prior to compaction in open areas, and 6 in. in depth in confined areas, such as adjacent to footings and pipes. Compact each layer with a minimum of four coverages of the equipment described below to obtain at least 95 percent of maximum dry density as determined by ASTM Test D1557.
   b. Compaction equipment in open areas shall consist of vibratory rollers or other compaction equipment approved by the Owner's Representative. In confined areas (in trenches, corners, etc.), compaction equipment shall consist of hand-guided vibratory equipment or mechanical tampers as approved by the Owner's Representative.
3. Compaction Requirements:
   a. Within the limits of the structure, below foundations, and under paved areas (i.e., roadways, sidewalks, parking areas, etc.), place fill in layers not exceeding 9 in. in depth measured prior to compaction and compact by suitable compaction equipment to at least 95 percent of maximum dry density as determined by ASTM Test D1557.
   b. Under landscaped areas, place fill in layers not exceeding 12-inch in depth prior to compaction and compact by suitable compaction equipment, approved by the Owner's Representative, to at least 92 percent of maximum dry density, as determined by ASTM Test D1557.
   c. Embankment fill areas shall have fill placed in maximum 12-inch-thick lifts and compacted to at least 92 percent of maximum dry density, as determined by ASTM Test D1557. Embankment fills shall not contain organic soil or debris.
4. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water from appearing on surface during or subsequent to compaction operations.
   a. Remove and replace, or scarify and air dry soil material that is too wet to permit compaction to specified density.
   b. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by disking, harrowing or pulverizing, until moisture content is reduced to a satisfactory value.

E. Freezing Weather:

1. Soil bearing surfaces below proposed or completed slabs and foundations shall be protected against freezing. Frost protection shall be provided in a manner acceptable to the Owner's Representative.
2. Do not excavate to full indicated depth when freezing temperatures may be expected. Protect the bearing foundation level and excavation level.
3. Where footings or subgrade is exposed to freezing temperatures, they shall be protected to prevent damage to the concrete by freezing or frost penetration into the soil upon which they rest.

F. Wet Weather:
1. Backfill placement, spreading, rolling, compaction, or other activities shall not be performed during wet weather (e.g., rain, snow, drizzle) or other weather that is not acceptable to the Owner's Representative.

PART 4 - MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Soil Excavation and Backfilling will not be measured but will be paid for as part of the Base Contract Price and shall include furnishing all material, mobilization, labor, equipment, tools, and incidentals necessary to complete the work shown on the Drawings. No separate measurement or payment will be made for acquisition of permits, backfill, equipment, ABC material disposal, temporary excavation support systems, construction dewatering, stockpiling, police details, material rehandling, surveying, or other associated items or work considered incidental to the conduct the work of this Section.

B. Excavation for the Contractor's convenience, unauthorized excavation outside the limits indicated and backfill of such excavations will not be measured for payment.

4.2 PAYMENT

A. All work shall be conducted as part of the Base Work and paid for as part of the Base Contract Price.

END OF SECTION 31 00 00

SECTION 32 12 00 – ASPHALT PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions, Division 0 and Division 1, General Requirements, apply to the work of this Section.

1.02 DESCRIPTION OF WORK

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to furnish and install ASPHALT PAVING, as indicated on the Contract Documents and as specified herein.

B. The work of this Section includes, but is not limited to the following:

1. New asphalt concrete paving
2. Gravel base course construction
3. Patching and resurfacing disturbed paved areas
4. Pavement markings
5. Bituminous Material

1.03 RELATED WORK

A. Carefully examine all the Contract Documents for requirements that affect the work of this Section. Other specification sections that directly relate to the work of this Section include, but are not limited to the following:

1. Section 012300 – Alternates
2. Section 024113 – Site Preparation
3. Section 310000 – Earthwork
4. Section 321313 – Exterior Concrete
5. Section 321400 – Unit Pavers
6. Section 321600 - Curbing
7. Section 323000 - Site Improvements
8. Section 334000 – Storm Drainage Utilities

1.04 SUBMITTALS

A. At least 30 days prior to intended use, submit material certificates signed by material producer and Contractor indicating that products comply with requirements. Provide master mix formula for all bituminous concrete specified in this Section, listing quantities and pertinent ingredient properties for review and approval.

B. Do not order materials until Architect's approval of mix formula has been obtained. Delivered materials shall closely match the approved samples.

C. Submit product data for traffic marking paint.

1.05 PROJECT CONDITIONS

A. Weather: Perform work only when existing and forecasted weather conditions are within the limits established by referenced standards. Perform work only when ambient temperature is forecasted to be at least 50-degrees Fahrenheit and when temperatures have not been below 35-degrees Fahrenheit for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess amount of moisture or is in a frozen state.

B. Bituminous paving shall not be applied until the finished compacted gravel base has been tested and approved. A delay in paving after the gravel base is tested and approved may require recompaction and testing at no additional cost to the Owner.

C. Construction methods, transportation and delivery of mixtures, spreading, finishing, compaction joints, etc. shall conform to Section 460 of the Massachusetts Department of Transportation Standard Specifications for Highways and Bridges unless otherwise specified herein.

D. Substrates: Proceed with work only when substrate construction and penetrating work is complete and base is dry.

E. Traffic Control: Maintain access for vehicular and pedestrian traffic as required and for other construction activities.

F. Grade Control: Establish and maintain required lines and elevations.

1.06 REGULATORY REQUIREMENTS

A. Strictly comply with applicable codes, regulations and requirements of authorities having jurisdiction.

1.07 QUALITY ASSURANCE

A. Bituminous concrete shall be prepared, mixed, transported, placed, compacted and finished in accordance with the requirements set forth in the latest edition of the "Standard Specifications for Highways and Bridges" (hereinafter referred to as "SSHB"), as published by the Massachusetts Department of Transportation.

B. Tolerances

1. Establish and maintain grade control to required elevations and slope tolerances indicated on the Drawings. The maximum deviation in the finished surface planarity shall be 3/16 inch when measured in any direction with a 10 ft. straightedge.

C. Laser-guided grading equipment shall be used for final grading of the gravel base to ensure conformance with specified tolerances

1.08 TESTING

A. During the placing and rolling operation, repeated checks shall be made to ascertain the correct rate of application to provide the required compacted thickness

B. If the average thickness is deficient from the specified thickness by one quarter (1/4) inch or more, the extent of the deficient area shall be corrected at the Contractor's expense.

C. Upon completion of testing, the Contractor shall properly fill all test holes by compacting a fine aggregate bituminous concrete for the full depth of the core. The finished surface shall be smooth.

1.09 COORDINATION

A. This Contractor shall coordinate with all other trades especially grading, curb installation, electrical and plumbing contractors, in order to prevent covering up unfinished or uninspected work. Any rework shall be done at no cost to the Owner.

1.10 LAYOUT AND GRADES

A. A Registered Land Surveyor or Registered Professional Engineer employed by the Contractor shall lay out all lines and grade work in accordance with the Contract Documents.

1.11 DISTURBING EXISTING PAVEMENT DURING CONSTRUCTION

A. Existing paved areas shall be protected from damage by construction activities to the extent possible. Where sections of the finished paved areas have to be removed, the edges shall be saw cut in all cases and patched.

B. Existing finished paved areas that require extensive cutting and patching or have become damaged and cannot be satisfactorily repaired by cutting and patching shall be resurfaced. These resurfaced areas shall be large enough to be applied by paving machines. Shape of these resurfaced areas shall be near and in rectangular patterns or shall conform to the shape or edges of other adjacent surface improvements. Edges of resurfaced areas shall be saw cut and existing pavements shall be removed from a distance of two feet into areas to be resurfaced, so that now pavement can neatly blend into existing pavement showing no joints or imperfections. If the gravel base course has been disturbed, the Contractor shall remove the disturbed material, repair the existing gravel base and apply a new binder course as specified herein.

C. All paving beyond the project's property line shall be in accordance with the requirements of the authority having jurisdiction. Provide traffic control for any work within the Town's Right-of-Way.

PART 2 - PRODUCTS

2.01 ASPHALT PAVING MATERIALS AND PRODUCTS

A. Course Aggregates: Provide clean, sound, angular crushed stone, crushed gravel, complying with ASTM D 692-88. This material shall contain a minimum of 75-percent light colored pieces.

B. Fine Aggregate: Provide sharp-edged natural sand or sand prepared from stone, gravel or combination thereof, complying with ASTM D 1073.

C. Tack Coat: Asphalt tack coat shall be diluted asphalt emulsion SS-1.

2.02 ASPHALT PAVING MIXES

A. Provide Class I asphalt aggregate mixture in compliance with Section 460, Paragraph 460.40, SSHB and as follows:

1. Binder Course and Top Course: Provide Binder Course and Top Course conforming with the Job-Mix Formula given in Section M, paragraph M3.11.03, SSHB.

2. The Binder Course shall consist of one lift of Binder Course asphalt paving to thickness as shown on the Contract Documents. The aggregate for the binder course shall conform to the following gradation requirements:

SIEVE SIZE	PERCENT PASSING
1”	100
3/4”	80 – 100
½”	55 - 75
#4	28 – 50
#8	20 - 38
#30	8 – 22
#50	5 - 15
#200	0 - 5
Bitumen % of mix	4.5 - 5.5

3. The Top Course shall consist of one lift of Top Course asphalt paving to thickness as shown on the Contract Documents. The surface tolerance after completion shall be 1/8 inch when measured in any direction with a 10 ft. straightedge. The aggregate for the top course shall conform to the following gradation requirements:

SIEVE SIZE	PERCENT PASSING
5/8”	100
1/2”	95 – 100
3/8”	80 - 100
#4	50 - 76
#8	37 - 54
#30	17 - 29
#50	10 - 21
#200	2 - 7
Bitumen % of mix	5.5 – 7.0

A.C. 20 of 30
Voids content less than 9%.

2.03 PAVEMENT MARKINGS

A. Paint striping for roadways, parking areas, crosswalks and lane designations shall be reflectorized traffic paint, as specified in the “Standard Specifications” under Sections M7.01.10. and M7.01.11, respectively.

1. Provide international symbol of accessibility at the designated handicap parking spaces. Color for all parking space lines and painted symbol of accessibility shall be white. Background for symbol of accessibility shall be handicap blue.

2. Stenciled pavement markings for "fire lane", "reserve parking", or "visitor parking" shall be installed on pavements as shown on the plans.

   a. Contractor shall install traffic paint in straight and true lines. Stall lines shall be four inches wide with length and spacing as indicated on the Drawings

2.04 BITUMINOUS MATERIALS

A. Bituminous material for tack coat shall be one of the following:

1. Cut-back asphalt (rapid curing type) conforming to AASHTO M81, Grade RC-70 or
2. Emulsified asphalt rapid-setting type conforming to AASHTO M140, Grade RS-1

B. Bitumen shall be rapid setting type emulsified asphalt conforming to AASHTO M 140, Grade RS-1.

C. Bituminous crack sealer shall be a hot-applied bituminous sealer conforming to Fed. Spec. SS-S-1401.

PART 3 - EXECUTION

3.01 GRADING AND COMPACTION OF SUB-BASE

A. Do all necessary grading in addition to that specified under Section 312000 Earthwork to bring subgrade or foundation after final compaction to required grades and sections to obtain a foundation of uniform bearing surface. In absence of specific requirements, compact foundation by such means as will provide firm base and insurance against settlement of superimposed work.

B. Sub-base preparation, including material, shall be of properly approved quality as specified under Section 312000 Earthwork. Start of work under this Section shall constitute acceptance of the foundation conditions to which this work is to be applied. Any defects in work resulting from such conditions shall be corrected under this Section, Site Improvements, at no additional cost to the Owner.

3.02 INSTALLATION OF ASPHALT PAVING

A. Preinstallation examination Required: The Installer of asphalt concrete shall examine the sub base and all related work, and the conditions under which this work is to be performed and notify the Contractor in writing of all deficiencies and conditions detrimental to the proper completion of their work. Beginning work means Installer accepts substrates, previous work, and conditions.

B. Reference Standards: Install asphalt concrete in strict compliance with Sections 460.60 through 460.68 of the State Standard Specifications, except where more restrictive requirements are specified.

C. Subbase Inspection: Do necessary grading in addition to that specified under Section Earthwork to bring sub-grade to required grades and sections for bituminous pavement base course construction. Tamp traces of trenches. Remove spongy and otherwise unsuitable material and replace with approved material. Loosen exceptionally hard spots and recompact. Take every precaution to obtain a foundation of uniform bearing strengths. Any defects in this work shall be corrected under this Section at no additional cost to the Owner.

D. Gravel Base Course Preparation: shall consist of approved gravel fill and placed on approved subgrade to the depth indicated and as specified under Section 312000 Earthwork. The surface of the gravel base shall be shaped to the cross section of the pavement. The start of work under this Section shall constitute acceptance of the foundation conditions to which this work is to be applied.

1. The gradation shall conform to Gravel Borrow as specified in Section 312000 Earthwork. Gradation shall be determined by a mechanical wet sieve analysis and in accordance with ASTM D-422.

2. The gravel shall be spread in layers from self-spreading vehicles or with power graders of approved types, or by hand methods upon the prepared subgrade. The gravel shall be compacted to not less than 95-percent of the maximum dry density of the material as determined by the Method of Test for ASTM Designation D - 1557, Method D. Grading and compaction shall continue until the surface is even and true to the proposed lines and grades within a tolerance of 3/8-inch above or below the required cross sectional elevations and to a maximum irregularity not exceeding 3/8-inch under a ten foot line longitudinally. Any specific area which after being rolled, does not form a satisfactory, solid foundation shall be removed, replaced and recompacted. The gravel shall be spread and compacted in layers not exceeding 6-inches in compacted thickness. The Contractor shall furnish, set and maintain all line and grade stakes necessary to guide the automated grade control equipment.

3. Contractor shall maintain base course in an acceptable condition, protected from traffic, erosion and other elements until the surface is placed.

4. After the subgrade and /or existing pavement surfaces have been prepared as specified herein, the Contractor shall check all frames, covers, grates, water valve boxes and all miscellaneous castings that are located in the proposed pavement area to insure that all such items have been accurately positioned and set to the proper slope and elevation. All covers and grates shall be set flush with the required finished pavement surface. No depressions or mounds will be permitted in the pavement to accommodate inaccuracies in the setting of these appurtenances.

E. Tack Coat: Tack coat shall be applied to previously paved, hardened surfaces. Apply uniformly by mechanical means at a rate of 0.05 gal/s.y. after thoroughly cleaning such surfaces of all foreign matter and loose material. Surfaces shall be dry before the tack coat is placed. The tack coat shall be applied immediately prior to laying the new pavement.

F. Placing Mix: Paving shall be laid in two courses except as noted on the Drawings. The thickness of each course shall be as shown on the Drawings and <u>measured in place after compaction.</u> The first course shall be the Binder Course and the second course shall be Top Course as defined in "Table A" of Section M3.11.03 "Job-Mix Formula" of the SSHB. A minimum of two weeks shall pass between the installation of the binder course and top course.

1. Any unsatisfactory irregularities or defects remaining after the final compaction shall be corrected by removing and replacing with new material as specified, to form a true and even surface, All minor surface projections, joints and minor honeycombed surfaces shall be ironed

out smoothly to grade, as directed.

2. No vehicular traffic or loads shall be permitted on the newly completed pavement until stability has been attained and the material has cooled sufficiently to prevent distortion of loss of fines.

G. Rolling: Begin rolling mixture when asphalt concrete can bear weight of roller without excessive displacement. Roll at least three times and provide a smooth, compact, uniform surface free of roller marks. After first rolling repair displaced area as needed with additional hot material. Roll at least two additional times to thoroughly compact concrete to maximum density and to remove roller marks.

H. Tolerances: The finished surface of each hot-mixed asphalt course shall be tested for smoothness using a 10-foot straight edge applied parallel with and at right angles to the center line of the paved area. Surfaces exceeding the following tolerances within the 10-feet will not be accepted.

Binder Course: 1/4-inch Top Course: 3/16-inch

3.03 PATCHING EXISTING ASPHALT PAVEMENT

A. In areas on site where new pavement abuts existing pavement and/or where existing pavement requires patching due to removal of existing pavement for installation of work under this Contract, patching of existing pavement shall be as follows:

1. Sawcut the existing edge of pavement in a straight line at a 90-degree angle to the vertical in such a manner that all existing loose or cracked areas of pavement are removed.

2. Edges of existing pavement shall be painted with a thin coat of bitumen (RS-1) immediately before placing new pavement.

3. Any joints at junctions of old and new pavements shall be sealed with a hot poured rubber asphalt sealer and covered with sand.

4. Asphalt shall be installed as specified herein. Smooth transition surfaces shall be provided where new pavement abuts existing paved surfaces.

B. All asphalt patching work within public right-of-ways shall be completed in accordance with the requirements of the authority having jurisdiction.

1. Provide traffic control for work within the public right-of-way.

2. All road surfaces shall be cut by an approved mechanical means before any excavation is started to insure against unnecessary damage to pavement.

3. Excavation shall be completed in a safe and workmanlike manner and is to create a minimum amount of obstruction to pedestrian and or vehicular traffic.

4. Gravel Borrow shall be used and placed on six inch layers and compacted to 95% of the maximum dry density by mechanical means.

5. Resurfacing:

a. The work to be completed hereunder shall include the replacement of all existing bituminous pavements disturbed by the work. This shall include roadways, sidewalks, berms, driveways, parking lots and other paved areas encountered in the work. Resurfacing will not be strictly limited to those areas disturbed, when in the judgment of the Architect an expansion of the work is necessary for proper restoration and to those

areas specifically shown on the Drawings.

b. All work shall conform the requirements of the Massachusetts Highway Department SSHB, latest edition. Specific gradations of mix will be as directed by the Town Engineer or Architect to suit the use intended.

c. All cut joints at existing and new top pavement surfaces shall be sealed with bitumen and sand. This includes roadways, sidewalks, driveways, and all other pavements.

3.04 PAVEMENT MARKINGS

A. Work under this item shall be in conformance with Section 860 of the Standard Specifications and the Manual on Uniform Traffic Control Devices, current edition.

B. Provide painted parking stripes and other pavement markings, as indicated on the drawings. Apply paint with mechanical methods and templates to ensure uniform, straight lines and even line widths. Clean surface to completely eliminate all loose material and dust. Apply paint in strict compliance with manufacturer's instructions and recommendations. Allow for proper curing of substrates before application of paints. Apply number of coats and dry film thickness as recommended by paint manufacturer.

3.05 CLEANING, REPAIR AND PROTECTION

A. Three days after rolling, the finished pavement shall be tested. Any section that shows ponding, indentation, rutting or picking up shall be resurfaced at the Contractor's expense.

B. Provide temporary protection to ensure work is completed without dirt, stains, damage or deterioration at time of final acceptance. Clean up stains and spills as they occur. Remove protection and clean as necessary immediately before final acceptance review.

3.06 GUARANTEE

A. The Contractor shall guarantee all pavement installations, including materials and workmanship, for a period of one year from the date of acceptance. The Contractor shall make interim repairs as necessary to maintain all paved areas in good, usable conditions.

END OF SECTION

SECTION 32 16 00 – CURBING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

This section is only a portion of the Contract Documents. All of the Contract Documents, including Conditions of the Contract and Division 1 General Requirements, apply to this section.

1.02 DESCRIPTION OF WORK

A. The work of this Section includes, but is not limited to the following:

1. New and Salvaged Vertical Granite Curb
2. New and Salvaged Sloped Granite Edge

1.03 RELATED WORK

A. Carefully examine all of the Contract Documents for requirements that affect the work of this Section. Other specification sections that directly relate to the work of this Section include, but are not limited to, the following:

1. Section 312000 Earthwork
2. Section 321200 Asphalt Paving
3. Section 321313 Exterior Concrete
4. Section 323000 Site Improvements
5. Section 334000 – Storm Drainage Utilities

1.04 INTENT

A. The intent of the work of this Section is to provide curbing which complies with Commonwealth of Massachusetts, Department of Transportation, “Standard Specifications for Highways and Bridges,” (hereinafter referred to as SSHB) Section 500, “Curb and Edging”.

B. Department of Public Works: All work within any public way and all work affecting any public way, including without limitation, roadways, sidewalks, curbs, and other work shall be done in strict compliance with the requirements of the authority having jurisdiction including local and State Standard Specifications, except when Standard Specifications are in conflict with these specifications, the most restrictive and inclusive requirements shall govern.

1.05 SUBMITTALS

A. Shop Drawings: The name of the Contractor shall be shown on the shop drawings. Finished

work shall conform to approved samples and shop drawings.

1. Provide large scale, detailed and complete shop drawings/placement drawings showing all curbing work for approval including all dimensions, radii and vertical to flush transition curbs with lengths clearly indicated.

2. Provide an itemized schedule of all curb pieces. Curbing shall be individually listed by type with radius and straight pieces noted with their lengths. Transition and corner curbs shall be individually listed.

B. Product Data: Submit manufacturers' certifications stating that materials comply with requirements.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products adequately protected against damage. Handle in strict compliance with manufacturer's instructions and recommendations and store off the ground. Protect from all possible damage including, but not limited to, chipping, staining, cracking and other damage. Cracked, chipped, or stained units will be rejected and shall not be utilized in this work. Sequence deliveries to avoid delays, but minimize on-site storage.

1.07 COORDINATION

A. The work of this Section shall be coordinated with that of other trades affecting or affected by the work of this Section, including paving work to be done by others, as necessary to assure the steady progress of the Work.

PART 2 - PRODUCTS

2.01 GRANITE CURB

A. Granite shall be "New England" structural granite conforming to ASTM C 615, Class I Engineering Grade, suitable for curbstone use.

1. Curb shall be light gray, free from seams which impair structural integrity, and with percentage of wear less than 32 percent, as determined by ASTM C 131.

B. Vertical Granite Curb: Furnish vertical granite curbing, type VA-4 as described in Section M9.04.0 and M9.04.1 of the Massachusetts Department of Transportation SSHB. All curb shall be basically light gray in color, free from seams and other structural imperfections or flaws which would impair its structural integrity, and of a smooth splitting appearance. The top surface shall be sawed to an approximate true plane, and shall have no projections or depressions greater than 1/8 inch. The front and back arris lines shall be pitched straight and true and there shall be no projections on the back surface for 3 inches down from the top that would exceed a batter of 4" per foot. The front surface shall be at right angles to the planes of the top and ends and shall be smooth quarry split, free from drill holes. Minimum length shall be 6 feet unless otherwise shown on the Drawings.

1. Radial type VA-4 curb shall be used on all curves with a radius of 100 feet or less, where vertical granite curb is called for on the Drawings.

D. Vertical to Flush Transition Curb: Furnish vertical to flush transition curbs of same material as

adjacent curb where shown on the drawings, to taper the reveal of the reveal of the curb from 6 inches to 0 inches. Transition curb along a curve shall be of the same radius. The curb shall be manufactured for the purpose intended at the plant and shall not be field cut.

2.02 MORTAR

A. Cement mortar shall conform to Section M4.02.15 of the Massachusetts Department of Transportation SSHB.

B. Concrete for curb setting shall be 5,000 lb. concrete as specified in Section 321313 Exterior Concrete.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All curbing shall be installed after the installation of the Binder Course and prior to installation of the Top Course. Curb shall be set to the line and grade required and shall project six inches above finished grade elevations where not otherwise shown as flush or as a transition.

B. Preinstallation Examination Required: The installer shall examine previous related work, and conditions under which this work is to be performed and notify Contractor in writing of all deficiencies and conditions detrimental to the proper completion of this work. Beginning work means installer accepts substrates, previous work, and conditions.

C. Manufacturer's Instructions: Strictly comply with Mass. S.S.H.B. including Section 500 of the latest edition for the installation of specified curb, unless these specifications are more restrictive. In such cases these specifications will prevail.

D. Trench Preparation: Curb shall be set in a trench excavated to a width of 20 inches. The bottom of the trench shall be 6 inches deeper than the depth of the curbstone. The subgrade shall then be filled to proper levels with a minimum of 6 inches of compacted gravel borrow at the lines and grade shown on the plan to provide continuous support to the bottom of curb. Gravel borrow shall be thoroughly rammed or tamped until firm and unyielding.

E. Granite Curb Installation: Set curbs true to line and grade with vertical exposed curb faces plumb and with curb top surface parallel to adjacent surfaces. The maximum space between joints shall not be more than 1/4 inch. Place concrete continuously along the front and back of the curb as indicated on the Detail. The curbing contractor shall confirm true vertical and horizontal alignment immediately after setting concrete and adjust curb sections as necessary to provide a true line. Joints as described under pointing below.

F. Pointing Joints in Granite Curb: The joints between curbstones and edging (both front and back) shall be carefully filled with cement mortar and neatly pointed on the top and front exposed portions. After pointing, the curbstones or edging shall be satisfactorily cleaned of all excess mortar that may have been forced out of the joints and that may be on the exposed surfaces of the curb.

G. Tolerances: The following installed tolerances are allowable variations from locations and dimensions indicated by the Contract Documents and shall not be added to allowable tolerances indicated for other work.

1. Allowable Variation from True Plumb: 1/8-inch over exposed face.
2. Allowable Variation from True Line: =1/4-inch in 20-feet.

3.02 REPAIR, CLEANING AND PROTECTION

A. Repair minor damage to eliminate all evidence of repair. Clean exposed surfaces using non-abrasive materials and recommended methods. Remove and replace damaged or unsuitable work that cannot be successfully cleaned or repaired.

B. Provide temporary protection to ensure work is without damage or deterioration at time of final acceptance. Remove protections and re-clean as necessary immediately before final acceptance.

C. After completion of the work in this Section, the Contractor shall remove all debris, materials, rubbish, etc. from the site and legally dispose of them. New or existing improvements that have been damaged in the work under this Contract shall be repaired to the satisfaction of the Architect.

END OF SECTION

SECTION 32 30 00 – SITE IMPROVEMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. This section is only a portion of the Contract Documents. All of the Contract Documents, including Conditions of the Contract and Division 1 General Requirements, apply to this section.

1.02 DESCRIPTION OF WORK

A. The work of this section includes, but is not limited, to the following:

1. Grading and Compaction of Sub-Base
2. Traffic and Parking Signs
3. Hay Scale Sign

1.03 RELATED WORK

A. Carefully examine all the Contract Documents for requirements that affect the work of this Section. Other specification sections that directly relate to the work of this Section include, but are not limited to the following:

4. Section 012300 – Alternates
5. Section 024113 - Site Clearing and Preparation
6. Section 312000 - Earthwork
7. Section 321200 - Asphalt Paving
8. Section 321313 – Exterior Concrete
9. Section 321600 - Curbing

1.04 SUBMITTALS

A. Shop Drawings: Refer to individual site improvements for submittal requirements.

B. Provide manufacturer's product material information and system performance data along with material and system samples for each item specified in this Section for the Architect's review and approval prior to ordering materials.

C. The General Contractor shall verify by field inspection that all items within this section conform to the specified requirements and approved submittals prior to installation.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products and provide adequate protection against damage. Handle in strict compliance with manufacturer instructions and recommendations and store off the ground. Protect from all possible damage including, but not limited to chipping, staining, cracking and other damage. Sequence deliveries to avoid delays, but minimize on-site storage.

1.06 COORDINATION

A. The work of this Section shall be coordinated with that of other trades affecting, or affected by, this work as necessary to assure the steady progress of the work of this Contract.

B. Substrates: Proceed with work only when substrate construction and penetrating work is complete.

1.07 GUARANTEE

A. In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTARY GENERAL CONDITIONS, the Contractor shall provide the manufacturers' standard written warranty for each product within this specification. All of these guarantees shall be in addition to, and not in lieu of, other liabilities that the Contractor may have by law or other provisions of the Contract Documents.

PART 2 - PRODUCTS AND EXECUTION (Combined)

2.01 GRADING AND COMPACTION SUB-BASE

A. Do all necessary grading in addition to that specified under Section 312000 - Earthwork to bring subgrade or foundation after final compaction to required grades and sections to obtain a foundation of uniform bearing surface. In absence of specific requirements, compact foundation by such means as will provide firm base and insurance against settlement of superimposed work.

B. Sub-base preparation, including material, shall be of properly approved quality as specified under Section 312000 - Earthwork. Start of work under this Section shall constitute acceptance of the foundation conditions to which this work is to be applied. Any defects in work resulting from such conditions shall be corrected under this Section 323000, Site Improvements, at no additional cost to the Owner.

2.02 TRAFFIC AND PARKING SIGNS

A. Provide highest quality 3M Scotchlite (or approved equal) on aluminum traffic signs. Sign backgrounds, legends and borders shall be fabricated from high-intensity encapsulated lens reflective sheeting conforming to the Massachusetts Department of Transportation's Standard Specifications for Highways and Bridges and the Manual on Uniform Traffic Control Devices (MUTCD), latest editions. Provide signs with the following characteristics, and per Signage Legend on the Drawings:

1. Mounting: Tamperproof stainless steel bolted fasteners to 12-gauge galvanized steel 2" square posts, except where shown mounted to light poles or otherwise noted on plan. Final locations to be determined in field. Mounting height shall conform to MUTCD standards. Concrete footings per Contract Documents.

2. Sign panels shall be 16 gauge aluminum panels. Sizes, color and copy as indicated on the Drawings.

3. Lettering and symbols shall be surface applied 3M Scotchlite reflective vinyl material

Series #580 or approved equal. All lettering shall be executed in such manner that all edges and corners of the letterforms are true, clean, correctly spaced, and photographically precise. All lettering and graphics must accurately reproduce the letterform. Colors shall be consistent with highway standards.

4. Letterform meeting referenced standards. Where no standard exists, letterform shall be as selected by the Architect.

5. Provide shop drawing submittal for those signs with no MUTCD code.

2.03 HAY SCALE SIGNAGE

A. Basis of design is Model “Frame Mount Style Sign” by Vacker Sign (Quantity 1) with following specifications

1. Frame mount style with removable top rail. 1/8” thick non-self supporting sign panel.

2. Traditional marking film / special protective over-laminate

3. Size shall be 18”x24” panel with single post

4. Frame to fasten to 3”x3” aluminum post with a welded plate at 30 degrees.

5. Fasteners shall be stainless steel

B. Other approved manufacturers

1. Model “Single Pedestal” by Pannier Graphics, www.panniergraphics.com

2.04 CLEANING, REPAIR AND PROTECTION

A. Repair minor damage to eliminate all evidence of repair. Remove and replace work that cannot be satisfactorily repaired.

B. Provide temporary protection to ensure that the work will be without dirt, stains, damage or deterioration at time of final acceptance. Clean up stains and spills as they occur. Remove protections and clean as necessary immediately before final acceptance.

END OF SECTION

SECTION 32 31 00 – FENCING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 apply to the work of this Section.

1.02 DESCRIPTION OF WORK

A. The work of this section is part of Add Alternate 2 and includes, but is not limited, to the following:

1. Vertical Wood Slat Fence
2. Cleaning, Repair and Protection

1.03 RELATED WORK

A. Carefully examine all the Contract Documents for requirements that affect the work of this Section. Other specification sections that directly relate to the work of this Section include, but are not limited to the following:

1. Section 012300 – Alternates
2. Section 024113 - Site Preparation
3. Section 312000 - Earthwork
4. Section 321200 - Asphalt Paving
5. Section 323000 - Site Improvements
6. Section 033000 - Cast-in-Place Concrete

1.04 SUBMITTALS

A. Refer to individual site improvements for additional submittal requirements.

B. Provide manufacturer's product material information and system performance data along with material and system samples for each item specified in this Section for the Landscape Architect's review and approval prior to ordering materials.

C. The General Contractor shall verify by field inspection that all items within this section conform to the specified requirements and approved submittals prior to installation.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products and provide adequate protection against damage. Handle in strict compliance with manufacturer instructions and recommendations and store off the ground. Protect from all possible damage including, but not limited to chipping, staining, cracking and other damage. Sequence deliveries to avoid delays, but minimize on-site storage.

1.06 COORDINATION

A. The work of this Section shall be coordinated with that of other trades affecting, or affected by, this work as necessary to assure the steady progress of the work of this Contract.

B. Substrates: Proceed with work only when substrate construction and penetrating work is complete.

1.07 REFERENCE STANDARDS

A. Chain Link Fence Manufacturers Institute (CLFMI)
B. American Society of Testing and Materials (ASTM)

1.08 GUARANTEE

A. In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTARY GENERAL CONDITIONS, the Contractor shall provide the manufacturers' standard written warranty for each product within this specification. All of these guarantees shall be in addition to, and not in lieu of, other liabilities that the Contractor may have by law or other provisions of the Contract Documents.

PART 2 – PRODUCTS

2.01 VERTICAL WOOD SLAT FENCE

A. Submit detailed shop drawings showing all fabrication and installation details, hardware and joining details.

B. The fence shall be constructed with cedar posts, brackets, post caps and northern white cedar wood slats.

C. Wood shall be Grade 2 northern white cedar 2x4 slats conforming with ASTM F537.

D. Screws shall be galvanized steel in accordance with ASTM F-1222.

E. The fence shall Northern White Cedar Wood Fence "J-Style Cedar Fence" system by Arrow Fence Co. Inc., Marlborough, MA tel 508-485-3334 or approved equal.

1. Schedule 40 Posts and brackets for wood fences shall be hot-dipped galvanized steel in accordance with ASTM –F626.
2. Total height of fence shall be 8'.

F. Install fence and gate in accordance with the drawings and manufacturer's instructions.

G. Representative photo of the fence

PART 3 – EXECUTION

3.01 CLEANING, REPAIR AND PROTECTION

A. Repair minor damage to eliminate all evidence of repair. Remove and replace work that cannot be satisfactorily repaired.

B. Provide temporary protection to ensure that the work will be without dirt, stains, damage or deterioration at time of final acceptance. Clean up stains and spills as they occur. Remove protections and clean as necessary immediately before final acceptance.

C. Upon completion of the work and before acceptance, the Contractor shall remove and dispose of in an approved manner all surplus materials, rubbish, etc. which the Contractor may have accumulated during the course of the work and shall leave the site in a clean and orderly condition. The Contractor shall not abandon any material at or near the site regardless of whether or not it has any value.

END OF SECTION

SECTION 32 90 00 – PLANTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 apply to the work of this Section.

1.02 DESCRIPTION OF WORK

A. The work of this Section includes providing all labor, equipment, materials, incidental work, and construction methods necessary to perform all planting work and related items as indicated on the Contract Documents and as specified in this Section and includes, but is not limited to, the following:

1. Planting trees, shrubs, groundcovers, bulbs and perennials
2. Planting maintenance
3. One-year plant guarantee period for all plants
4. Inspection and acceptance
5. Cleaning and protection

1.03 RELATED WORK

A. Carefully examine the site and all of the Contract Documents for requirements that affect the work of this Section. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions. Other specifications sections that directly relate to the work of this Section include, but are not limited to, the following:

1. Section 012300 – Alternates
2. Section 024113 - Site Preparation & Clearing
3. Section 322000 - Earthwork
4. Section 323000 - Site Improvements
5. Section 329100 - Loam and Planting Soil Preparation
6. Section 329200 - Turf and Grasses

B. The work of this Section shall be coordinated with that of other trades affecting, or affected by, this work, as necessary to assure the steady progress of all work of the Contract.

1. The planting subcontractor shall become fully acquainted with the nature and requirements of the project including the location of all underground utilities prior to starting the work of this Section.

1.04 REFERENCES

A. The following standards shall apply to the work on this Section.

1. American National Standards Institute (ANSI):
Z60.1 American Standard for Nursery Stock,, latest edition, published by American Association of Nurserymen, (AAN).

1.05 SUBMITTALS

A. Material Samples and testing:

1. Provide full analysis of existing on-site loam, and off-site loam source from a laboratory that has been approved in writing by the Architect. Sampling and testing shall be as specified, and performed under the work of Section 32 91 00 Loam and Planting Soil Preparation.

2. Planting mulch: submit one gallon-sized Ziploc bag.

3. Provide manufacturers' certified analysis for soil amendments and fertilizers.

1.06 REGULATORY REQUIREMENTS

A. Strictly comply with all applicable codes, regulations and requirements having jurisdiction.

B. All fertilizer and pesticide applications shall be performed by a licensed applicator in strict conformance with all local, state and federal regulations. Notify the Owner's Project Representative at least two (2) weeks prior to scheduled date of application.

1.07 QUALITY ASSURANCE

A. Subcontract planting work to a single landscape construction company specializing in this work. All work shall be performed by experienced landscape professionals familiar with planting procedures and under the full-time supervision of a qualified foreman. The General Contractor shall notify the Architect in writing upon the selection of a landscape subcontractor and arrange for a pre-construction meeting between the Architect, General Contractor, and Subcontractor. Such meeting shall seek to establish the proposed schedule, source of plants, consideration of substitutions and general review of procedures.

B. Inspection of Plant Materials: Plant materials are subject to inspection and approval upon delivery to the project site. Certificates of inspection of plant material shall be furnished as may be required by Federal, State and other authorities. No plants shall be planted until required inspections have been made and the plants approved.

C. Label at least one tree and one shrub of each species within each plant grouping with a securely attached waterproof tag bearing legible designation of botanical and common

name.

1.08 PLANTING SEASONS

A. Complete landscaping work as quickly as possible as portions of the site become available for this work. Work only within seasonal limitations for proper planting as follows:

Type of Plant Material	Spring Season	Fall Season
Evergreen Trees & Shrubs	April 15 to June 1	Aug. 15 to Oct. 1
Deciduous Trees & Shrubs	Shall be planted in a dormant condition.	

B. Planting performed outside of these seasonal limitations will not be accepted unless approval is obtained in writing from the Architect. Any approved work outside of these seasonal limitations pertains only to the work to be performed in the season of the year requested.

1.09 DELIVERY, STORAGE AND HANDLING

A. Packaged Materials: Deliver packaged materials in manufacturer's original unopened containers showing weight, analysis and name of manufacturer. Comply with manufacturer's instructions and recommendations for storage and handling. Protect all materials from damage, deterioration, injury and theft while stored at the site.

1.10 EXAMINATION OF CONDITIONS

A. All areas to be planted shall be inspected by the Contractor prior to starting work and any incorrect grading or inadequate drainage shall be reported to the Architect prior to beginning work.

PART 2 - PRODUCTS

2.01 LOAM

A. Loam for planting shall be approved, specified, provided, and installed under the work of Section 32 91 00, Loam and Planting Preparation, and that has been pH adjusted according to particular planting applications and improved through the addition of organic material as directed under this Section.

B. Planting loam mix for groundcover, perennial and bulb planting shall have a pH value of 5.5 to 6.5, which has been thoroughly premixed with organic material in the proportions of one part organic matter (humus or compost), with 5 parts of approved loam. Organic material shall be specified, provided, and installed under Section 32 91 00, Loam and Planting Preparation.

2.02 SOIL ADDITIVES

A. Soil additives shall be specified, provided, and installed under the work of Section 32 91 00 Loam and Planting Preparation.

B. For trees/shrubs planted late in the season after October 1st (or any transplant) Use Granular Mycorrhizal inoculant product for plant establishment per manufacturer recommendation. Mycor Tree Saver Transplant as manufactured by Plant Health Care Inc, Pittsburgh PA, or approved equal as determined by Landscape Architect.

C. NutriPak slow-release tree and shrub fertilizer in two strengths – 1-2 years (fruit trees) and 3-5 years (hardwood). Apply as directed by the manufacturer.

2.03 STANDARD OF PLANTS

A. The Contractor shall furnish all plants shown on the Contract Documents. No substitutions will be permitted, without written approval by the Landscape Architect. Furnish plants which have been nursery grown in accordance with the American Standard for Nursery Stock of the American Nursery and Landscape Association (ANLA) and ANSI Z60.1 - latest edition, and which have been grown under climate conditions similar to those in the locality of the project. All plants shall conform to the varieties, sizes and quantities specified on the plans and typical of their species. They shall be free from insects, insect eggs, scale and/or disease. The root system of each shall be well provided with fibrous roots. Plants shall have a sound, healthy, well-formed upper growth with straight trunks, well-branched and densely foliated when in leaf. Plants shall be legibly tagged with its proper name for purposes of identification of plant material during planting.

1. Measurements: Height and spread dimensions specified refer to the main body of the plant and not from branch or root tip to tip. Measure the caliper of trees up to 4 inches at 6 inches above the ground level. Measure trees larger than 4 inches 1 foot above ground level.

2. Plants larger than specified in the plant list may be used if approved by the Architect, but use of such plants shall not increase the contract price. If the use of larger plants is approved, the spread of roots or ball of earth shall be increased in proportion to the size of the plant.

2.04 BARK MULCH

A. Bark Mulch: for planting beds shall be a 100% pine bark product free from lumps, dirt, or deleterious materials. Bark shall be substantially free from wood fibers. No pieces of bark shall exceed three (3) inches in any dimension, or be thicker than 1/4 inch. Mulch shall have been aged for a minimum of six months, and not longer than two years. Bark shall be no more than two years old. All plant beds shall receive a two to four inch layer of mulch, not to exceed four inches.

2.05 WATER

A. Water: shall be furnished by the Contractor from a legal off-site source via water truck and be suitable for irrigation, free of toxic ingredients. Sources of water at or near the site that are made available to the Contractor are a convenience to the Contractor. Limitations of site water sources shall be supplemented by off-site sources at the Contractor's expense to meet the maintenance requirements of this Section. Any municipal fees associated with providing water for this work shall be borne by the Contractor.

1. Watering Equipment: The Contractor shall furnish sufficient watering equipment to distribute water evenly with complete coverage daily to all seeded areas.

2. All new and transplanted trees shall be furnished and installed with 20 gallon, slow release watering Treegator bags or approved equal. Manufactured by Spectrum Products, Inc., Youngsville, NC, phone 1-800-treegator.

2.06 ANTIDESICCANTS

A. Antidesiccants (as required based on planting conditions) shall be emulsions or other materials which will provide a protective film over plant surfaces permeable enough to permit transpiration and specifically manufactured for that purpose. Antidesiccant shall be “Wilt-Pruf” available from Nursery Specialty Products, Inc., New York, N.Y. or approved equal, and mixed and applied according to the manufacturer’s instructions.

2.07 TREE ANCHORING MATERIALS

A. Stakes: For supporting small trees under 3” caliper shall be of sound wood uniform in size, reasonably free of knots, and capable of standing in the ground at least two years. Stakes shall be 2”x 4,” not less than eight and one half feet in length and stained dark brown.. All trees 3” caliper or over shall be supported by guying cable as per planting detail.

B. Arbor Ties: Utilize Arbortie by Deeproot, or approved equal, when staking and guying plant material.

PART 3 - EXECUTION

3.01 PLANTING

A. All plant roots and earth balls must be kept damp and thoroughly protected from sun and drying winds at all times from the beginning of the digging operation, during transportation, and on the ground until the final operation of planting.

B. Prior to spreading loam, subgrades shall have been tested to determine if they are too compact to drain water as specified.

C. Plant material Selection: at least one month prior to the expected planting date, the Contractor shall request that the Landscape Architect select and tag plants to be planted as specified. The Contractor shall pay for the transportation, subsistence and overnight accommodations, if necessary, for the Landscape Architect's representative during the period of time required to select and tag the plant material.

1. The Contractor shall be responsible to certify the availability of quality plants in specified sizes from his/her sources of supply prior to requesting that the Landscape Architect make plant source inspections. In the event that plants at the inspection location are found to be unavailable or of insufficient size, the Contractor shall be liable to reimburse the Owner for all costs of the Landscape Architect's hourly services which are incurred during unproductive inspection trips.

2. Unless specifically designated otherwise, a representative of the Contractor shall accompany the Landscape Architect on all plant material selection field trips.

3. Representative samples only of shrubs, perennials and groundcover plants may be tagged or marked for approval as an "Approved Typical Sample" and shipped to the site. Any shrub or groundcover plant that arrives at the construction site that does not meet the Approved Typical Sample will be rejected by the Landscape Architect.

4. Inspection and approval of plants at the source shall not impair the right of subsequent inspection and rejection upon delivery to the site, or during the progress of the work if the Landscape Architect finds that plants do not meet the requirements of the PLANT LIST or this Contract, have declined noticeably due to handling abuse, lack of maintenance, or other causes. Cost of replacements, as required, shall be borne by the Contractor.

D. Contractor shall locate all existing underground utilities of the proposed planting and notify the Architect of any conflicts prior to digging.

E. Locations for all plants shall be staked-out on the ground and approved by the Architect before any excavation is made. Adjustments in locations shall be made as directed by the Architect. Planting shall be in accordance with the planting details on the Drawings.

F. The Contractor shall take special care to ensure that the plant material is not planted too deeply by removing burlap and soil mounded around the base of the plant, at the top of the rootball, to expose the trunk flare. A measurement shall be taken from the trunk flare to the bottom of the root ball. This measurement shall be the depth of the planting hole.

G. The plants shall be set at the center of the holes with trunk flare level to, or 1” – 2” above, finish grade. Once plant is set in planting pit, the Contractor shall remove the top 12” minimum, of wire basket and all visible rope and burlap.

H. Hole shall be backfilled in layers of loam not more than nine inches and each layer watered sufficiently to settle before the next layer is put into place. Do not place any subsoil, sod or waste materials in planting hole.

I. Each tree and shrub shall be pruned in accordance with National Arborist Association Standards to preserve the natural character of the plant. Remove all tags, labels and dead or broken branches.

J. Staking of newly planted trees shall be performed directly after they are planted. Trees of 3-inch caliper or under, require staking only as needed to hold the tree plumb. All trees of 3-inch caliper and over shall be staked. Support ties shall allow tree to move and sway, but be able to return the trunk to a plumb and true position. Contractor shall adjust staking as frequently as needed during the maintenance period.

K. A 2 – 4 inch settled layer of bark mulch shall be applied over the entire area of the plant beds. Plantings installed over three months prior to the date of substantial completion shall be weeded and replenished with fresh mulch to specified thickness prior to acceptance.

L. Provide a soil saucer equal to the diameter of the hole around each tree. Particular attention shall be made to create saucers at sloped areas that contain water around the base of the plant. Soil saucers shall be repaired and maintained as needed to perform effectively during the maintenance period.

M. Plants shall be watered at a rate of 3–5 gallons per inch of caliper twice within the first twenty-four (24) hours of the time of planting.

3.02 MAITENANCE

A. Trees, Shrubs, Perennials, and Groundcover Plantings:

1. The Contractor shall maintain plantings until the date of substantial completion or until the date of acceptance, whichever is later.

2. Maintenance shall begin immediately after each plant is planted and shall include watering, weeding, pruning, pest control, removal of dead materials and otherwise maintaining plants. Correct defective work as soon as possible after it becomes apparent and weather and season permit. Reset settled plants to proper grade and position, restore planting saucer, and remove dead material. Repair soil saucers around trees and replenish bark mulch to meet the specified thickness as needed throughout the maintenance period.

3. Watering: The Contractor shall include in his base bid costs for weekly watering of all plant areas for the entire first growing season. The required watering frequency will vary depending on temperature and natural rainfall. The Contractor shall respond to adverse weather conditions in a timely manner to maintain the moisture level in the soil necessary for proper plant establishment. Plants shall be watered at a rate of 3-5 gallons per inch of caliper. Slow release watering bags shall be filled weekly during this period. Plants subjected to drought stress during the required maintenance period may become unacceptable as determined by the Architect and require replacement at no additional cost to the Owner.

4. Anti-desiccant: Treat plants subject to desiccation at the time of planting and again prior to winter according to the manufacturer's recommendations.

5. During the maintenance period, any decline in the condition of plantings shall require the Contractor to take immediate action to identify potential problems and undertake corrective measures. If required, the Contractor shall engage professional arborists and/or horticulturalists to inspect plant materials and to identify problems and recommend corrective procedures. The Landscape Architect shall be immediately advised of such actions. Inspection and recommendation reports shall be submitted to the Architect.

3.03 ACCEPTANCE

A. Upon completion of planting work per Construction Phase, the Contractor shall request in writing that the Landscape Architect formally inspect the planting work. The General Contractor, Owner, and landscape Architect shall walk all areas of completion to determine date of turnover to the Owner.

B. Following the correction of all Punch List deficiencies, the Contractor shall request in writing that the Landscape Architect formally inspect the planting work. If plant materials and workmanship are acceptable, the Landscape Architect will issue a written Certificate of Final Acceptance to the Contractor.

3.04 PLANT GUARANTEE

A. The date of the Certificate of Final Acceptance shall establish the commencement of the required one-year guarantee and establishment period for planting work.

B. At the end of the guarantee and establishment period, a final inspection will be held to determine whether any plant material replacements are required. Plants found to be unacceptable shall be removed promptly from the site and replaced.

C. All replacements shall be plants of the same kind and size originally specified. The cost shall be borne by the Contractor, except for possible replacements due to vandalism or neglect on the part of others.

3.05 CLEANING AND PROTECTION

A. During operations, keep pavements clean and work area in an orderly condition. Protect all plantings from damage by other contractors and trades and trespassers. After completion of the work, the Contractor shall remove all debris, materials, rubbish, excess dirt, etc. from the site and dispose of them in a legal manner. The premises shall be left clean and presentable to the satisfaction of the Architect.

END OF SECTION

SECTION 32 91 00 – LOAM AND PLANTING PREPARATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 apply to the work of this Section.

1.02 DESCRIPTION OF WORK

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to perform all lawns, plantings and related work as indicated on the Contract Documents and as specified in this Section and includes, but is not limited to, the following:

1. Subgrade preparations
2. Loam from off-site,
3. Sampling and testing of off-site loam
4. Sand
5. Modifying, screening, placing, spreading and grading of loam
6. Fine grading
7. Inspection and acceptance
8. Cleaning and protection

1.03 RELATED WORK

A. Carefully examine the site and all of the Contract Documents for requirements that affect the work of this Section. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions. Other specifications sections that directly relate to the work of this Section include, but are not limited to, the following:

1. Section 02 41 13 - Site Preparation and Clearing
2. Section 32 12 00 - Asphalt Paving
3. Section 32 13 13 - Exterior Concrete
4. Section 32 16 00 - Curbing
5. Section 32 20 00 – Earthwork
6. Section 32 30 00 - Site Improvements
7. Section 32 31 00 - Fencing
8. Section 32 90 00 – Planting
9. Section 32 92 00 - Turf and Grasses

B. The work of this Section shall be coordinated with that of other trades affecting, or affected by, this work, as necessary to assure the steady progress of all work of the Contract.

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM):

D 75	Practice for Sampling Aggregates
D 422	Test Method for Particle-Size Analysis of Soils
D698-00a	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3)
D1557	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures using 10-lb rammer and 18-in. drop

B. A.O.A.C.: Association of Official Agricultural Chemists.

1.05 SUBMITTALS

A. At least 30 days prior to ordering materials, the Contractor shall submit to the Architect representative samples, certifications, manufacturer's product data and certified test results for materials as specified below. No materials shall be ordered or delivered until the required submittals have been reviewed and approved by the Architect. Delivered materials shall closely match the approved samples. Approval shall not constitute final acceptance. The Architect reserves the right to reject, on or after delivery, any material that does not meet these Specifications.

B. Loam from off-site: The Contractor shall provide a one cubic foot representative sample per each 1,000 cubic yard proposed stockpile of loam borrow for testing. All stockpile sampling shall be per ASTM D 75 and Appendixes for securing samples from stockpiles.

C. Testing will be at the Contractor's expense. Contractor shall deliver all samples to testing laboratories via overnight courier and shall have the testing report sent directly to the Architect. Perform all tests for gradation, organic content, soil chemistry and pH by UMASS Soil and Plant Tissue Laboratory, West Experiment Station, 203 Paige Laboratory, 161 Holdsworth Way, Amherst, MA 01003, (413) 545-2311. Testing reports shall include the following tests and recommendations.

1. Mechanical gradation (sieve analysis) shall be performed and compared to the USDA Soil Classification System.

2. Percent of organics shall be determined by the loss on ignition of oven-dried samples. Test samples minus #10 material shall be oven-dried to a constant weight at a temperature of 450 degrees Fahrenheit (752 degrees Centigrade).

3. Chemical analysis shall be undertaken for Nitrate Nitrogen, Ammonium Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, extractable Aluminum, Lead, Zinc, Cadmium, Copper, Soluble Salts, and pH and buffer pH. A Conductivity Meter shall be used to measure Soluble Salts in 1:2 soil/water (v/v). Except where otherwise noted, nutrient tests shall be for available nutrients.

4. Soil analysis tests shall show recommendations for soil additives to correct soils deficiencies as necessary, and for additives necessary to accomplish lawn and planting work as specified.

D. In-Place Testing

1. Density Tests: ASTM D1556 Density of soil and rock in place using “Sand Cone Method" or ASTM D6938-08a Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth). ASTM D698 Test Method

for Laboratory Compaction Characteristics of Soil Using Standard Effort. (Standard Proctor).

a. In-place density tests shall be carried out at a rate of one test per each plant bed or lawn area.

b. Soil density shall meet the requirements specified herein, see PART 3.

2. As required, in-place infiltration tests shall be performed using Turf-Tec IN2-W Infiltrometer utilizing manufacturer's operating instructions, or accepted alternate.

3. At the direction of the Landscape Architect in-place planting soil blends shall be sampled and tested by the Owner for compliance with gradation and organic matter content as specified herein. Non-compliant materials shall be removed from the site or amended as specified by the Soil Scientist.

E. Compost: Submit supplier's certification of contents being supplied conforms to these Specifications.

F. Limestone: Submit supplier's certification that the limestone being supplied conforms to these Specifications.

G. Acidulant: Submit supplier's certification that the acidulant being supplied conforms to these Specifications.

1.06 REGULATORY REQUIREMENTS

A. Strictly comply with all applicable codes, regulations and requirements having jurisdiction.

B. All fertilizer applications shall be performed by a licensed applicator in strict conformance with all local, state and federal regulations. Notify the Owner's Project Representative at least two (2) weeks prior to scheduled date of application.

1.07 EXAMINATION OF CONDITIONS

A. The Contractor and any sub-Contractor responsible for the execution of the Work of this Section, shall review the subgrades and elevations to verify that the subgrades have been prepared as required by the Contract Documents, prior to proceeding with the spreading of the planting loam. Carefully review the requirements of this Section, to understand the requirements of percolation testing, compaction, slope and absence of debris of the subgrade prior to spreading of the tested and approved loam.

B. The Contractor shall be solely responsible for judging the full extent of work requirements involved, including but not limited to sampling and testing of all materials prior to final planting installation.

1.08 DEFINITIONS / QUALITY ASSURANCE

A. The following definitions shall apply to the work of this Section.

1. The following size distributions of mineral particles by diameter and sieve size shall apply to the following conventional names of soil types:

Conventional Name	Retained on U.S. Sieve No.	Diameter (mm)
Very coarse sand	#18	1 - 2
Coarse sand	#35	0.5 - 1
Medium sand	#60	0.25 - 0.5
Fine sand	#140	0.10 - 0.25
Very fine sand	#270	0.05 - 0.10
Silt	by hydrometer	0.002 - 0.05
Clay	by hydrometer	Less than 0.002

2. Subgrade: Soil material and levels resulting from the approved rough grading work.

3. Imported Loam: Loam obtained from an approved soil supplier for off-site manufacture of soil blends to be imported to the project site.

4. Lawn and Planting Soils: Lawn and Planting Soils are composed of a blend of three base components: base loam, organic material and sand. The quality of the blend depends on the quality of the original components. Locate and obtain approval of sources for base loam, organic material and sand that meet the Specification requirements. Contractor is then responsible for mixing the components.

B. Contractor is solely responsible for quality control of the Work.

C. The installer shall be a company having at least 5 years of successful experience of a scope similar to that required for the Work, including the preparation, mixing and installation of custom Planting Soil and planting mixes in urban locations.

1. The installing contractor shall be the same firm that is installing planting as described in Section 329000 – PLANTING.

2. Installer Field Supervision: Installer to maintain an experienced full-time supervisor on Project site when any Planting Soil preparation work is in progress.

3. The installer's crew shall be experienced in the installation of soil, grading and interpretation of grading plans in urban areas.

D. Soil work shall be performed by a company that has sufficient earthwork machinery at the job site simultaneously to amply provide for the vigorous execution of the site work without interruption or delay, except for unforeseen circumstances, such as weather. Machinery operators shall be well experienced in this type of work.

E. Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.

G. Comply with all requirements for control of silt and sediment during soil installation work as indicated in the contract documents. Provide additional silt and sediment control to maintain silt and sediments within the working area as required by the progress of the work or as directed by the Landscape Architect

H. Pre-installation Conference: Conduct conference at project site prior to the start of any work related to Planting Soil preparation and shall meet the requirements of this Section.

I. Layout and Grading:

1. Permanent benchmarks shall be established by a registered land surveyor or professional civil engineer, at the Contractor's expense. The Contractor shall maintain established bounds and benchmarks and replace them, if any are destroyed or disturbed.

1. The Contractor shall maintain at the site, sufficient surveying equipment to accurately excavate to the required subgrade and install soil to the required finish grade. The Contractor shall be responsible to install soil profiles at the elevations and thickness shown on the Plans.

PART 2 - PRODUCTS

2.01 LOAM

A. Loam: The Contractor shall provide loam as necessary to complete the work of this Section from approved off-site sources. The Contractor shall submit samples and an analysis from each proposed source of material. Provide loam that is fertile, friable, natural loam reasonably free from subsoil, clay lumps, glass, brush, litter, roots, stones, viable invasive plant tissue/seeds and other foreign materials.

B. Loam shall be one of the following sandy loams; “coarse sandy loam”, or “sandy loam” determined by mechanical analysis ASTM D-422 and based on the USDA Classification System, and as defined in this Section. It shall be uniform in composition, without admixture of subsoil. It shall be free of stones greater than one and one-quarter inches, lumps, plants and their roots, debris and other extraneous matter, such as glass, brick, metals, plastics, etc. as determined by the Landscape Architect.

1. Planting loam for trees, shrubs, groundcover and vines, and perennials shall have the following grain size distribution for material passing the #10 (2.0 mm) sieve:

	Percent Passing by Weight	
U.S. Sieve Size No.	Minimum	Maximum
10	100	
18	85	95
35	60	85
60	42	65
140	21	44
270	18	24
0.002mm	2	4

a. The final mix shall have an organic content between 5 and 7 percent by weight.
b. pH shall be between 5.5 and 6.5.
c. Gravel in the loam mix shall be <10%.
d. The ratio of the particle size for 80% passing (D80) to the particle size for 30% passing (D30) shall be 6 or less (D80/D30 <6)
e. The final mix shall have a hydraulic conductivity of not less than 1.5 inches per hour according to test procedure ASTM D5856-95 (2000) when compacted to a minimum of 86 percent Standard Proctor ASTM D 698. Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422 after destruction of organic matter by ignition.

2. Planting loam for general lawns shall have the following grain size distribution for material passing the #10 (2.0 mm) sieve:

	Percent Passing by Weight	
U.S. Sieve Size No.	Minimum	Maximum
10	100	100

18	70	90
35	45	72
60	28	44
140	16	24
270	12	16
0.002mm	2	4

a. On-site and off-site loam shall be screened to achieve above specified sieve analysis and to remove invasive plant vegetative matter.
b. Percent Gravel in the loam mix shall be <10%.
c. Organic content shall be between 3.5 and 5.0 percent by weight.
d. pH shall be between 6.3 and 6.8
e. Saturated hydraulic conductivity of the mix shall not be less than 2.0 inches per hour according to ASTM D5856-95 (2000) when compacted to a minimum of 88% Standard Proctor, ASTM 698.

C. Organic content: organic matter of the loam shall be based on samples that pass a 1/4" sieve and determined by the wet combustion method on a sample dried at 105 degrees.

D. Loam borrow shall be pH adjusted for particular planting applications and shall be adjusted prior to delivery to the Project sites as recommended by UMASS Soil & Plant Tissue Laboratory test results.

1. When pH of loam borrow is equal to or greater than 7 use aluminum sulfate to adjust pH downward to required levels.

2. When pH of loam borrow is less than 7 use either sulfur or ferrous sulfate to adjust pH downward to required levels.

3. When pH of loam borrow must be raised to the required levels use limestone.

4. Regardless of amendment Contractor chooses to use, Contractor, not the Owner, shall be responsible for obtaining specified pH by seeding and/or planting time.

E. Loam shall be uncontaminated by salt water, foreign matter and substances harmful to plant growth. Topsoil shall not have levels of extractable aluminum greater than 200 parts per million except for acid-loving plants. Cation Exchange Capacity (CEC) shall be between 10 and 15.

F. All planting loam provided from off-site sources shall be brought to the site meeting all specification requirements. There must be no mixing or amending of soil on site. The loam borrow must not be handled or moved when in a wet or frozen condition.

G. To assure planting loam purchased and screened loam stockpiled fulfills specified requirements regarding textural analysis, organic matter content, and pH, soil testing results will be obtained by the Contractor and submitted to the Architect for approval before any soil is delivered to the site.

2.02 SOIL ADDITIVES

A. Soil additives shall be used to counteract soil deficiencies as recommended by the soil analysis.

B. Lime: Provide approved agricultural limestone containing not less than 85% of total carbonates with a minimum of 30% magnesium carbonates. Lime shall meet

Massachusetts Department of Food and Agriculture standards for Fine-Sized Classification so that 50% passes a 100 mesh, 60% passes through a 60-mesh sieve, and 95% will pass a 20 mesh sieve.

C. Aluminum Sulfate shall be unadulterated, 57% (Ortho Division, Chevron Chemical Company), or approved equal.

D. Compost: Provide compost as needed to raise the Organic Content of the topsoil to within specified range. Compost shall be:

1. Compost shall be derived from organic wastes including sawdust, clean ground wood, leaf and yard residues, and biosolids that meet all State Environmental Protection Agency requirements. The product shall be well composted, free of viable weed seeds and contain material of a generally humus nature capable of sustaining growth of vegetation, with no materials toxic to plant growth. The material shall be fully composted and to have maintained a temperature above 55 degrees Centigrade or 131 degrees Fahrenheit for at least 15 days per EPA/40 CFR Part 503. The composted material shall have a moisture content such that no visible free water or dust is produced when handling the material. Submit complete product analysis including: Organic Nitrogen, Carbon/Nitrogen Ratio, Total Phosphorous, Total Potassium, Organic Matter, pH, particle size and product density.

2. Compost products shall meet the following physical criteria:

Parameters	Range
pH	5.5 – 8.0
Moisture Content	35% - 55%
C:N ratio	15 – 30:1
Organic Matter	> 40%
Particle Size	< 3/4”
Soluble Salts	< 4.0 mmhos (ds)
Bulk Density	< 1200 lbs/cuyd
Foreign Matter	< 1% by weight
Solvita Maturity Rating	5 - 7

a. Acceptance of composted products shall be based on the following submittals by the Contractor:

i. A request for Approval of a Material Source.
ii. A copy of the Composting Permit for the Material Source selected.
iii. Certification by the supplier that the compost product meets state EPA guidelines and that it originates from 100 percent recycled vegetation material that has been aerobically composted.

E. Medium to Coarse Sand

1. Sand for Planting Soil Blends, protection of filter fabric and for drainage as required, shall be uniformly graded medium to coarse sand consisting of clean, inert, rounded to sub-angular grains of quartz or other durable rock free from loam or clay, mica, surface coatings and deleterious materials with the following grain size distribution for material passing the #10 sieve: Washed concrete sand typically meets Specification Requirements.

		Percent Passing	
1.	U.S. Sieve Size Number	Minimum	Maximum
	10	100	--
	18	60	80

35	25	45
60	8	20
140	0	8
270	0	3
0.002mm	0	0.5

2. Maximum size shall be one-inch largest dimension. The maximum retained on the #10 sieve shall be 20% by weight of the total sample.

3. The ratio of the particle size for 70% passing (D_{70}) to the particle size for 20% passing (D_{20}) shall be 2.8 or less (D_{70}/D_{20} <2.8). Tests shall be by combined hydrometer and wet sieving in compliance with ASTM D422.

4. pH shall be less than 7.5

F. Bone meal shall be fine ground, steam cooked, packing house bone with a minimum analysis of 23% phosphoric acid and 4% nitrogen.

PART 3 - EXECUTION

3.01 FILLING AND COMPACTION

A. Perform percolation tests on existing subsoils or placed fill prior to placing and spreading loam for planting:

1. Perform percolation testing of subsoil or placed fills to determine whether or not the subgrade will drain properly. Perform percolation tests as specified in this Section.

2. In the event that percolation testing indicates that the subsoil, placed fills or ordinary borrow has been over compacted and will not drain, the contractor shall loosen up the top 18 – 24” inches of the subgrade to be planted, seeded, or sodded by ripping or other mechanical means. Recompact the borrow by driving a small, tracked bulldozer over the area at low speeds so that the tracks of the bulldozer pass over the affected area and the soil is compacted to a density that will percolate as specified under the work of this Section. Under no circumstances shall wheeled vehicles be driven over subsoil, placed fills or ordinary borrow that have been shown to percolate or subsoil, placed fills or ordinary borrow that has been loosened and shown to percolate.

3. Perform sufficient percolation tests in areas of poorly draining or compacted subsoil or compacted placed fills as directed by the Architect to ensure that these underlying soils drain. Likewise, perform sufficient percolation tests after ripping and loosening to ensure that the soils are no longer too compact to drain.

B. Subsoil or ordinary borrow shall have been excavated and filled as required by the Contract Documents. Do not damage the work previously installed. Maintain all required angles of repose of materials adjacent to the loam as shown on the Contract Documents. Do not over excavate compacted subgrades of adjacent pavement or structures during loaming operations.

C. Confirm that the subgrade is at the proper elevation and that no further earthwork is required to bring the subgrade to proper elevations. Subgrade elevations shall slope parallel to the finished grade and or toward any subsurface drain lines as shown on the Contract Documents. Provide a written report to the Architect that the subgrade has been placed to the required elevations and

that the subgrade drains water at the rates specified under the required percolation tests specified, performed and paid for under this Section, Loam and Planting Preparation. Perform no work of placing and spreading loam until elevations have been confirmed and written report has been accepted by the Architect.

D. Clear the subgrade of all construction debris, trash, rubble and any foreign material. In the event that fuels, oils, concrete washout or other material harmful to plants have been spilled into the subgrade material, excavate the soil sufficiently to remove the harmful material. Such construction debris, trash, rubble and foreign material shall be removed from the site and disposed of in a legal manner. Fill any over excavation with approved fill and compact to the required subgrade compaction levels.

E. Do not proceed with the installation of loam until all utility work in the area has been installed.

F. Protect adjacent walls, walks and utilities from damage or staining by the loam. Use 0.5-inch plywood and or plastic sheeting to cover existing concrete, metal and masonry work and other items as directed during the progress of the work. Clean up all trash and any soil or dirt spilled on any paved surface at the end of each working day.

3.02 FINE GRADING

A. Before spreading loam, the Contractor shall furnish and install grade stakes sufficiently spaced to insure correct line and grade of the finished subgrade. The Contractor shall verify elevations and do whatever additional grading is necessary to bring the subgrade layer to a true, smooth slope parallel to the finish grade for all areas to receive loam.

B. Immediately prior to spreading loam, the subgrade shall be in a friable condition, as described herein, cleaned of all stones greater than 2 inches and all debris or rubbish. Such material shall be removed from the site, not raked to the edges and buried. Notify the Architect that the subsoil has been cleaned and request his/her attendance on site to review and approve subgrade conditions prior to spreading loam borrow.

C. Loam borrow delivered to the site shall be protected from erosion at all times. Materials shall be spread immediately. Otherwise, materials that set on site for more than 24 hours shall be covered with tarpaulin or other soil erosion system acceptable to the Architect and surrounded by silt fence.

D. No loam borrow shall be handled, planted, or seeded in any way if it is in wet, frozen or dusty conditions.

E. Soil additives shall be spread and thoroughly incorporated into the layer of loam by harrowing or other methods reviewed by the Architect. The following soil additives shall be incorporated:

1. Ground limestone or acidulant as required by soil analysis to achieve the required pH as described in this Section. Spread limestone at the rate required by soil analysis up to a maximum limit of 200 pounds per 1,000 square feet. Should recommendations of soil analysis require greater rates of application than 200 pounds per 1,000 square feet, a surface application of limestone not in excess of 50 pounds per 1,000 square feet shall be made to the established lawn during the season after Final Acceptance. This second application of limestone shall be performed and paid for under the work of Section 32 92 00, Turf and Grasses, at rates determined under the testing requirements of this Section, Loam and Planting Preparation.

3. Humus, compost, sand or other soil amendments as required by soil analysis.

F. Loam shall be sampled and tested as specified, performed and paid for under the work of

this Section, to verify application and incorporation of limestone, fertilizer and other soil amendments.

G. After loam and required additives have been spread, carefully prepare the loam by scarifying, harrowing, or tilling the loam to integrate soil additives into the top 6 inches of the loam. Remove all large stiff clods, lumps, brush, roots, stumps, litter and other foreign matter. Remove from unscreened soils all stones over 3/4 inch in diameter from the top 6 inches of the loam bed. Loam shall also be free of smaller stones in excessive quantities as determined by the Architect and as specified herein.

H. Sufficient grade stakes shall be set for checking the finished grades. Stakes must be set in the bottom of swales and at the top of slopes. Deviation from indicated elevations that are greater than one-tenth of a foot shall not be permitted. Connect contours and spot elevations with an even slope. Finish grades shall be smooth and continuous with no abrupt changes at the top or bottom of slopes.

I. During the compaction process, all depressions caused by settlement or rolling shall be filled with additional loam and the surface shall be regraded and rolled until presenting a smooth and even finish corresponding to the required grades.

J. The Contractor shall install loam in successive horizontal lifts no thicker than 6 inches in turf areas and 12 inches in plant bed areas to the desired compaction as described herein. The Contractor shall install the soil at a higher level to anticipate any reduction of loam borrow volume due to compaction, settling, erosion, decomposition, and other similar processes during the warranty period.

1. Compact loam to the required density as specified in Section 312000 Earthwork.

2. The surface area of each lift shall be scarified by raking prior to placing the next lift. Soils shall not be compacted with vibratory equipment.

K. In addition to the range cited above, compact each lift sufficiently to reduce settling but not enough to prevent the movement of water and feeder roots through the soil. The loam borrow in each lift should feel firm to the foot in all areas and make only slight heel prints. At completion of the loam borrow installation, the soil should offer a firm, even resistance when a soil sampling tube is inserted from lift to lift. After the placement of each lift, perform percolation tests to determine if the soil has been over compacted. Perform the following percolation test procedure:

1. Dig a hole in the installed soil that is a minimum of 4 inches in diameter. Holes in 6-inch lift in turf areas shall be 4 inches deep. Holes in 12-inch lifts in plant beds shall be 8 inches deep. Do not penetrate through the lift being tested.

2. Fill the hole with water and let it drain completely. Immediately refill the hole with water and measure the rate of fall in the water level.

3. In the event that the water drains at a rate less than one inch per hour, till the soil to a depth required to break the over compaction.

4. Perform a minimum of one soil percolation test per 10,000 square feet area of turf area and 2,500 square feet of tree and shrub planting area as directed by the Architect.

L. Select equipment and otherwise phase the installation of the loam to ensure that wheeled equipment does not travel over subsoil, placed fills or ordinary borrow or already installed soil. Movement of tracked equipment over said soils will be reviewed and considered for approval by the Architect. If it is determined by the Architect that wheeled equipment must travel over already installed soil, provide a written description of sequencing of work

that ensures that compacted soil is loosened and uncompacted as the work progresses or place one-inch thick steel plate ballast (or equivalent ballast approved by the Architect) over the length and width of any travel way to cover loam borrow to protect it from compaction.

M. Disturbed areas outside the limit of lawn work shall be graded smooth and spread with a minimum of 6 inches of loam to the finished grade.

3.03 PROTECTION

A. The Contractor shall protect landscape work and materials from damage due to landscape operations, operations by other Contractors or trespassers. Maintain protection during installation until acceptance. Treat, repair or replace damaged Planting Soil installation work immediately.

B. Provide all means necessary, including fences, to protect all soil areas from compaction and contamination by trash, dust, debris, and any toxic material harmful to plants or humans after placement. Any area that becomes compacted, shall be de-compacted and tilled to the extent determined by the soil scientist and recompressed to the density ranges specified. Any uneven or settled areas shall be filled, re-graded and re-compacted to meet the requirements of this Specification. Soil that becomes contaminated shall be removed and replaced with specified soil material.

C. Phase the installation of the planting soil such that equipment does not have to travel over already installed planting soil. Use of haul roads is acceptable provided that the haul road is completely re-worked to meet the requirements of this Specification. Under no circumstances shall heavy equipment or trucks be allowed to traverse placed topsoil or prepared subgrade unless said equipment is tracked or has low ground pressure tires.

D. Apply filter fabric covering and planking or other engineering controls over soil to minimize compaction and collect dust and debris in any area where the Contractor must work after the installation of Planting Soil.

E. Till compacted Planting Soil and replace Planting Soil that has become contaminated as determined by the Landscape Architect. Planting Soil shall be tilled or replaced by the Contractor at no expense to the Owner.

3.04 ACCEPTANCE / POST INSTALLATION TESTING

A. Confirm that the final grade of the loam borrow is at the proper finish grade elevations. Adjust grade as required to meet the contours and spot elevations noted on the Plans. Request the presence of the Architect to inspect final grade. Do not proceed with the remaining work of this Contract until the Architect has given his/her written approval of the final grade.

B. In-place density testing is required in all areas. Placed lawn and planting soils must be inspected for compaction level by the soil scientist or by the following acceptable Density Test Methods: ASTM D1556 Density of soil and rock in place using Sand Cone Method, ASTM D6938-10 Nuclear Methods, ASTM D2167-08 Rubber Balloon method, after ASTM D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. Density testing shall be conducted at a minimum of one test for each lift in each plant bed or a minimum of one test for every 1,000 square feet.

C. Placed Lawn and Planting Soils must be capable of infiltrating water at the minimum rate provided in this Specification for each type of planting soil

END OF SECTION

SECTION 32 92 00 – TURF AND GRASSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 apply to the work of this Section.

1.02 DESCRIPTION OF WORK

A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to perform all planting work and related items as indicated on the Contract Documents and as specified in this Section and includes, but is not limited to, the following:

1. Seeding
2. Installation of erosion control blanket
3. Maintenance
4. Inspection and acceptance
5. Cleaning and protection

1.03 RELATED WORK

A. Carefully examine the site and all of the Contract Documents for requirements that affect the work of this Section. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions. Other specifications sections that directly relate to the work of this Section include, but are not limited to, the following:

1. Section 02 41 13 - Site Preparation and Clearing
2. Section 31 20 00 – Earthwork
3. Section 32 30 00 - Site Improvements
4. Section 32 90 00 - Planting
5. Section 32 91 00 – Loam and Planting Preparation
6. Section 33 40 00 – Storm Drainage Utilities

B. The work of this Section shall be coordinated with that of other trades affecting, or affected by, this work, as necessary to assure the steady progress of all work of the Contract.

1. The planting subcontractor shall become fully acquainted with the nature and requirements of the project including the location of all underground utilities prior to starting the work of this Section.

1.04 SUBMITTALS

A. Submit the Massachusetts Certified Landscape Professional certificate for the landscape foreman who will be performing the daily supervision of the landscape installation.

B. Submit the current license of the Massachusetts Licensed Pesticide Applicator who will

be applying pesticides.

C. Material Samples and testing:

1. Provide full analysis of existing on-site loam, and off-site loam source from a laboratory that has been approved in writing by the Architect. Sampling and testing shall be as specified, and performed under the work of Section 329100 – Loam and Planting Preparation
2. Provide manufacturers' certified analysis for soil amendments and fertilizers to meet the requirements of this Section.
3. Provide certified analysis for seed mixtures required including percentages of purity, germination and weed seed.
4. Provide current catalog cuts and specifications for incorporating mulch and soil stabilizer for hydroseed mix.
5. Product Data

1.05 REGULATORY REQUIREMENTS

A. Strictly comply with all applicable codes, regulations and requirements having jurisdiction.

B. All fertilizer and pesticide applications shall be performed by a licensed applicator in strict conformance with all local, state and federal regulations. Notify the Architect at least two (2) weeks prior to scheduled date of application.

1.06 QUALITY ASSURANCE

A. All work shall be performed by experienced landscape professionals familiar with planting procedures and under the full-time supervision of a qualified foreman.

B. Analysis of Materials: For each type of packaged material required for the work of this Section, provide manufacturers' certified analysis.

1.07 DELIVERY, STORAGE AND HANDLING

A. Packaged Materials: Deliver packaged materials in manufacturer's original unopened containers showing weight, analysis and name of manufacturer. Comply with manufacturer's instructions and recommendations for storage and handling. Protect all materials from damage, deterioration, injury and theft while stored at the site.

1.08 EXAMINATION OF CONDITIONS

A. All areas to be seeded shall be inspected by the Contractor prior to starting work and any incorrect grading or inadequate drainage shall be reported to the Architect prior to beginning work.

PART 2 - PRODUCTS

2.01 LOAM

A. Loam for all seeded areas shall be furnished and installed under Section 32 91 00, Loam and Planting Preparation.

2.02 SOIL ADDITIVES

A. Soil additives shall be furnished and installed under Section 32 91 00 Loam and Planting Preparation.

2.03 SEED

A. Seed Material: Provide fresh, clean, new-crop seed complying with tolerance for purity and germination establish by Official Seed Analysis of North America. Seed shall be composed of the following varieties that shall be mixed in the proportions stated and shall test to minimum percentages of purity and germination. Deliver seed in fully labeled, standard, sealed containers. Seed that has become wet, moldy, or otherwise damaged, will not be accepted.

B. Type 1 Seed, General Lawn (non-irrigated), shall have the following seed mixture composition:

Common Name	Proportion By Weight	Percent Purity	Percent Germination
Cochise IV Fescue	80%	95%	90%
Fiesta 4 Perennial Ryegrass	10%	95%	90%
Impact Kentucky Bluegrass	10%	85%	90%

1. All varieties shall be within the top 50 percent and 25 percent respectively, of varieties tested in National Turfgrass Evaluation Program, or currently recommended as low maintenance varieties by University of Massachusetts or the University of Rhode Island.

2. Seeding rate for the seed mix shall be 6 pounds per 1,000 square feet.

E. Conservation Seed Mix:

1. Seed mix shall be “New England Conservation/Wildlife Mix” as supplied by New England Wetland Plants, Inc., 820 West St., Amherst, MA 01002, Phone: (413) 548-8000.

2. Seed Mix Rate of application shall be 30 lbs. per acre (1,452 sq. ft. per lb.) if sown in the Fall, or 25 lbs. per acre (1,742 sq. ft. per lb.) if sown in the Spring/Summer season. Seed mixture compositions shall be:

Common Name	Botanical Name
Big Bluestem	Andropogon gerardii
Little Bluestem	Schizachyrium scoparium
Switchgrass	Panicum virgatum
Partridge Pea	Chamaecrista fasciculate
Canada Wild Rye	Elymus Canadensis
Common Milkweed	Asclepias syriaca
Flat-top Aster	Aster umbellatus
Creeping Red Fescue	Festuca rubra
Deer Tongue	Panicum clandestinum
Indian Grass	Sorghastrum nutans
Ox Eye Sunflower	Heliopsis Helianthoides
Purple Joe Pye Weed	Eupatorium purpureum
Grass Leaved Goldenrod	Euthamia graminifolia
Blue Vervain	Verbena hastate
Golden Alexanders	Zizia aurea
Early Goldenrod	Solidago juncea

F. Restoration Seed Mix for Moist Soils:

1. Seed mix shall be “New England Erosion control/Restoration Mix for Moist Soils” as supplied by New England Wetland Plants, Inc., 820 West St., Amherst, MA 01002, Phone: (413) 548-8000.

2. Seed Mix Rate of application shall be 35 lbs. per acre if sown in the Fall, or 30 lbs. per acre if sown in the Spring/Summer season. Seed mixture compositions shall be:

Common Name	Botanical Name
Elymus virginicus	Virginia Wild Rye
Festuca Rubra	Creeping Red Fescue
Schizachyrium scoparium	Little Bluestem
Carex vulpinoidea	Fox Sedge
Andropogon gerardii	Big Bluestem
Panicum virgatum	Switch Grass
Agrostis scabra	Rough Bentgrass/Ticklegrass
Aster novae-angliae	New England Aster
Eupatorium perfoliatum	Boneset
Euthamia graminifolia	Grass Leaved Goldenrod
Verbena hastata	Blue Vervain
Scirpus atrovirens	Green Bulrush
Juncus effusus	Soft Rush
Scirpus cyperinus	Wool Grass

2.04 FERTILIZERS

A. Fertilizer shall be a commercial product complying with the State and United States fertilizer laws. Deliver to the site in the original unopened containers that shall bear the manufacturer's certificate of compliance covering analysis. Fertilizer shall contain not less than the percentages of weight of ingredients as recommended by the soil analysis.

B. Nitrogen fertilizer shall be slowly soluble ureaformaldehyde, methylene urea, or isobutylidene diurea; or slow release sulfur-coated urea.

C. Phosphorus content shall be 0.0% in compliance with current Massachusetts regulations.

D. Potassium shall be sulfate of potash, K2SO4.

E. Salt indexes per unit of nutrient for nitrogen, phosphorous, and potassium shall be less than 1.0 when compared to sodium nitrate (6.3).

2.05 LIMESTONE

A. Ground limestone for adjustment of loam borrow pH shall contain not less than 85 percent of total carbonates and shall be ground to such fineness that 40 percent will pass through 100 mesh sieve and 95 percent will pass through a 20 mesh sieve. Contractor shall be aware of loam borrow pH and the amount of lime needed to adjust pH to specification in accordance with testing lab recommendations.

2.06 WATER

A. Water: shall be furnished by the Contractor from a legal off-site source via water truck and be suitable for irrigation, free of toxic ingredients. Sources of water at or near the site that are made available to the Contractor are a convenience to the Contractor. Limitations of site water sources shall be supplemented by off-site sources at the Contractor's expense to meet the maintenance requirements of this Section. Any municipal fees associated with providing water for this work shall be borne by the Contractor.

1. Watering Equipment: The Contractor shall furnish sufficient watering equipment to distribute water evenly with complete coverage daily to all seeded areas.

2.07 STRAW

A. Straw for mulch at seeded areas shall be mowings of acceptable herbaceous growth reasonably free from noxious weeds or woody stems and shall be reasonably dry. No salt hay shall be used.

2.08 WOOD FIBER HYDRO MULCH

A. Wood Fiber Hydro Mulch: shall be derived from natural, clean, whole woodchips. Fiber shall not be produced from recycled material such as sawdust, paper, or cardboard fiber. It shall be dyed green to contrast with the soil on which it is to be applied. Fiber shall have a water holding capacity of not less than 31.5 ounces of water per 3.5 ounces of fiber. The rate of application for wood fiber mulch shall be in accordance with manufacturer's guidelines.

2.09 EROSION CONTROL MAT

A. The erosion control blanket shall be a machine-produced mat of 100% agricultural straw with a functional longevity of up to 12 months. The blanket shall be of consistent thickness with the straw evenly distributed over the entire area of the mat. The blanket shall be covered on the top and bottom sides with a 100% biodegradable woven natural fiber netting. The netting shall consist of machine directional strands formed from two

intertwined yarns with cross directional strands interwoven through the twisted machine strands (commonly referred to as a Leno weave) to form an approximate 0.50 x 1.0 in. (1.27 x 2.54 cm) mesh. The blanket shall be sewn together on 1.50 inch (3.81 cm) centers with degradable thread. The blanket shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats.

B. The straw erosion control blanket shall be S150BN as manufactured by North American Green, or Architect approved equal. The erosion control blanket shall have the following properties:

1. Material Content:

Matrix	100% Straw Fiber (0.50 lb/yd^2)
Netting	Top and Bottom: Leno woven 100% biodegradable organic jute
Thread	Biodegradable

2. Physical Specifications (per roll):

Width	8.0 ft
Length	112.0 ft
Weight	65.28 lbs
Area	100.00 yds^2

2.10 PESTICIDES (HERBICIDES, INSECTICIDES AND FUNGICIDES)

A. Provide pesticides meeting all Federal and State regulatory requirements as required to control weeds, insects and fungi.

B. Submit all product and compliance information for approval prior to application.

PART 3 - EXECUTION

3.01 GENERAL

A. All areas within the Limit of Work lines not required to be otherwise developed shall be seeded as shown in the Contract Documents. The Contractor shall restore all lawn areas disturbed because of this Contract with specified loam and seed, as directed by Owner, whether within or outside the Limit of Work line.

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3.02 PREPARATION OF SUBGRADE AND SPREADING OF LOAM

A. Preparation of subgrade and spreading of loam shall be specified, and performed under the work of Section 32 91 00 Loam and Planting Preparation.

3.03 FINE GRADING

A. Fine grading shall be specified, and performed under the work of Section 32 91 00 Loam and Planting Preparation.

3.04 SEEDING

A. Contractor shall obtain Landscape Architect's written approval of fine grading and soil preparation before doing any seeding work.

B. Seeding shall be done immediately after fine grading provided the seedbed has remained in a friable condition and has not become muddy or hard. If it has become hard, it shall be tilled to a friable condition and fine graded again.

C. The season for seeding shall be from April 1 to June 15 and from August 15 to October 15. The actual planting of seed shall be done, however, only during periods within this season which are normal for such work as determined by weather conditions and by accepted practice in this locality. To prevent loss of soil via water and wind erosion and to prevent the flow of sediment, fertilizer, and pesticides onto roadways, sidewalks, and into catch basins, seed loam areas within 5 Days of spreading the loam.

D. Do not seed when wind velocity exceeds 5 miles per hour. Distribute seed evenly over entire area by sowing equal quantity of seed specified or scheduled. Apply seed at one half the rate in two directions at right angles to each other. Roll the seeded areas lightly and water with a fine spray.

   a. If Hydroseeding Method will be used, furnish a certified statement prior to installation stating the number of pounds of materials to be used per 100 gallons of water. This statement shall also specify the number of square feet of hydroseeding that can be covered with the quantity of solution in the hydroseeder.

   b. Hydroseed with wood cellulose fiber mulch at a rate of 46 pounds per 1,000 square feet or 2000 pounds per acre.

   c. For the hydroseeding process, a mobile tank with a capacity of at least 500 gallons shall be filled with water and the mixture noted above in the specified proportions. The resulting slurry shall be thoroughly mixed by means of positive agitation in the tank. Apply the slurry by a centrifugal pump using the hose application techniques from the mobile tank. Only hose application shall be permitted. At no time shall the mobile tank or tank truck be allowed onto the prepared hydroseed beds. The hose shall be equipped with a nozzle of a proper design to ensure even distribution of the hydroseeding slurry over the area to be hydroseeded and shall be operated by a person thoroughly familiar with this type of seeding operation.

E. For slopes 3:1 and greater and where indicated on the plan, erosion control mat is required.

F. Install straw mulch or hydraulic wood fiber mulch in a separate application from seeding installation. Install mulch immediately after fine grading topsoil and seeding. Combining seed and mulch together in one hydroseeding application is not acceptable.

G. After the grass has germinated, all areas and parts of areas that fail to show a uniform stand of grass, for any reason whatsoever, shall be reseeded and such areas and parts

of areas shall be reseeded repeatedly until all areas are covered with a uniform germination.

3.05 LAWN MAITENANCE

B. Lawns areas to be mowed regularly

1. The Contractor shall maintain all seeded areas immediately after seeding. The Contractor is responsible for the initial establishment of new seedings and to request the Architect's approval of successful uniform germination at least 2 weeks prior to the first mowing. After acceptance of germination, the Contractor shall maintain seeded areas for a minimum of 60 days within the active growing season. Once plant growth has slowed due to heat or cold dormancy, the maintenance period shall continue over to the next growing season. A level of maintenance not meeting the requirements for acceptance may require the maintenance period to be extended as determined by the Architect.

2. Maintenance shall consist of watering, weeding, mowing, repair of ruts and erosion, repair of protective devices and reseeding.

3. Watering: The Contractor shall include in his base bid costs for daily and, if necessary, continuous watering of all seeded areas during a normal eight hour working day to maintain the seed bed in a continuous moist condition satisfactory for good germination and vegetation development. Control weeds as necessary to maintain seeded areas at 98% weed free.

4. The Contractor shall keep lawn mowed until Acceptance by cutting to a height of 2.5 inches when growth reaches 3.5 inches or as directed by the Landscape Architect.

5. At each mowing, all edges of walks, drives, plant beds and other border conditions shall be edge trimmed by hand or machine to produce straight and uniform edge conditions.

6. Remove and discard from paved areas only clippings and debris generated by each mowing and edging operation legally off-site. Landscape Architect, if practical and aesthetic, may allow sweeping (not blowing) clippings back into grass. Mowers shall be equipped with mulching blades. Do not remove from grass areas any clippings that have been generated by mowing operations. Do not mow grass when wet.

7. Maintenance shall include all temporary protection fences, barriers and signs and all other work, tools and equipment incidental to proper maintenance.

8. The Contractor shall be responsible for all maintenance of seeded areas necessary to meet the acceptance criteria specified herein.

9. The Contractor shall be responsible for providing mowing and maintenance of lawn areas in existence prior to construction that are made inaccessible to owner during construction, including areas outside of the Limit of Work line.

B. The Contractor shall keep all Lawn mowed until Acceptance of the contract by cutting to a height of 2.5 inches when growth reaches 3.5 inches or as directed by the Landscape Architect.

C. At each mowing, all edges at fences and individual objects shall be trimmed by hand or

machine to produce clean and uniform edge conditions.

D. Remove and discard clippings and debris generated by each mowing and edging operation legally off-site. Mowers shall be equipped with mulching blades. Do not remove from grass areas any clippings that have been generated by mowing operations. Do not mow grass when wet.

F. Following the completion of all lawn construction work, and until final acceptance of the project. In the event that seeding operations are completed too late in the Fall for adequate germination and growth of grass, then maintenance shall continue into the following Spring for the minimum 60 Day period.

H. Fertilizing at Lawn areas: A starter fertilizer shall be applied at the time of seeding. A second application of nitrogen fertilizer shall be applied to seeded areas approximately two months after seeding corresponding to the following application rates dependent upon the month of application.

1. May 1-15: Apply 1.0 pound of nitrogen per 1,000 square feet.
2. June 15-30: Apply 1.0 pound of nitrogen per 1,000 square feet.
3. August 15 through September 15: Apply 1.0 pound of nitrogen per 1,000 square feet.
4. November 1-15: Apply 1.5 pounds of nitrogen per 1,000 square feet.

Nitrogen fertilizer shall be composed of 50 percent slowly soluble or slow release nitrogen fertilizer.

3.06 NATIVE SEED MIX AREAS MAITENANCE

A. At a minimum the contractor shall provide

1. Deep and consistent waterings (up to daily if needed) until a successful germination and coverage occurs

2. Reseeding areas that do not take

3. Hand pulling and removal of weeds
4. Mowing: A 3' wide mown border shall be maintained along all curbing and paved areas until final completion of the project (or successful establishment of the seed mix) whichever comes later.

3.07 LAWN REVIEW AND ACCEPTANCE

A. At the end of the maintenance period, seeded areas shall have a close stand of grass as defined above with no weeds present and no bare spots greater than 3 inches in diameter over greater than 5 percent of the overall seeded area. At least 90 percent of the grass established shall be permanent grass species. If seeded areas are deficient, the Contractor's responsibility for maintenance of all seeded areas shall be extended until deficiencies are corrected. Seeded areas to be corrected shall be prepared and reseeded in accordance with the requirements of this Section, TURF AND GRASSES.

B. At the time of acceptance, the Contractor shall remove temporary barriers used to protect lawn areas.

C. The Architect shall review the lawns upon written request by the Contractor. The request shall be received at least ten days before the anticipated date of review.

D. The conditions of lawns will be noted and determination made by the Architect whether maintenance shall continue in any part. When acceptance is made in writing to the Contractor, the Contractor's responsibility for maintenance of lawns or parts of lawns shall cease.

E. Areas of lawn not meeting the criteria for establishment specified herein will be noted. Remedial work and maintenance shall continue until the lawn is accepted by the Owner.

3.08 CLEANING AND PROTECTION

A. During operations, keep pavements clean and work area in an orderly condition. Protect lawns from damage by other contractors and trades and trespassers. After completion of the work, the Contractor shall remove all debris, materials, rubbish, excess dirt, etc. from the site and dispose of them in a legal manner. The premises shall be left clean and presentable to the satisfaction of the Architect.

END OF SECTION

SECTION 33 40 00 – STORM DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes storm drain systems work as indicated on Drawings and schedules, and by requirements of this Section.

B. Related Work:

1. Section 31 20 00, "Earthwork".

1.2 SUBMITTALS

A. General: Submit the following in accordance with Division 01 General Requirements Specification Sections.

B. Product Data: Submit manufacturer's technical product data and installation instructions for storm drain system materials and products.

C. Shop Drawings: Submit shop drawings for storm drain systems including piping, manholes, catch basins, frames, covers, grates, dry wells, and hoods.

D. Record Drawings: At project closeout, submit record drawings of installed storm drain piping and products, in accordance with requirements of Division 01.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturing of storm drain system's products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firms with at least 3 years of successful installation experience on projects with storm drain work similar to that required for the project.

PART 2 – PRODUCTS

2.1 PIPES AND PIPE FITTINGS

A. General: Provide pipes of the following materials of class indicated. Provide pipe fittings and accessories of same materials and class as pipes with joining method, as indicated.

1. The piping shall be manufactured by an established manufacturer of good reputation in the industry and in a permanent plant adapted to meet all the design requirements of the pipe.

B. High Density Polyethylene (HPDE)

1. Description:

   This document shall govern for the furnishing and installation of all High Density Polyethylene (HDPE) Corrugated and Smooth Lined Pipe and / or materials for constructing of culverts, side road pipes, storm sewers, stubs, and all related connections and fittings, all of which shall conform to ASTM F 2306, latest edition. The pipes shall be of the sizes, types, and dimensions shown on the plans, and contained in this specification. In addition, it shall include all connections and joints to new or existing pipes, storm sewer manholes, inlets, headwalls, and other appurtenances as may be required to complete the work.

2. Materials:

   a. Unless otherwise specified on the plans or herein, thermoplastic pipe and joint fittings shall conform to the following: High Density Polyethylene (HDPE) Corrugated and Smooth Lined Pipe & Fittings shall be manufactured in accordance with requirements of ASTM F 2306 (ST joints acceptable), latest edition.

   b. High Density Polyethylene (HDPE) Corrugated and Smooth Lined Pipe shall be manufactured from virgin PE compounds which conform to the requirements of cell class 435400C as defined and described in the latest version of ASTM D 3350.

   c. Minimum Pipe Stiffness (PS) at five percent deflection shall be as described in ASTM F 2306, Section 6.3, when tested in accordance with ASTM D 2412.

   d. All High Density Polyethylene (HDPE) Corrugated and Smooth Lined Pipe suppliers shall conform to the quality control and product testing requirements in the American Association of State Highway and Transportation Officials (AASHTO) National Transportation Product Evaluation Program (NTPEP).

2.2 FRAMES AND COVERS

A. Frames and covers shall be of cast iron, min 490 lbs, diamond cover surface and shall be machined to fit securely and evenly on the frame:

- Lebaron Foundry Catalog No. LJ 101A,
- Neenah Foundry Catalog No. R-1556
- Sigma Corporation Catalog Ne. MH732D

2.3 MANHOLES

A. General: Provide precast reinforced concrete manholes of the size indicated, and complying with ASTM C 478.

B. Top: Precast concrete, of concentric cone, eccentric cone, or flat slab top type, as indicated in the drawings and details. Tops shall be designed to meet H20 loadings.

C. Base and riser sections: Precast concrete, with base riser section with integral floor, as indicated in the details. Manhole diameter, base and riser thicknesses shall be as indicated in the details.

D. Cement: Type II.

E. Concrete strength: 4,000 psi minimum.

F. Joints for precast riser sections: O-ring rubber gaskets or compressible joint filler,

- Kent Seal No. 2,
- Tremco Superstop,
- NPC" Bidco C-56.

G. Steps: 3/8-inch grade 60 steel reinforcing rod encapsulated with molded copolymer polypropylene.

H. Frame and Cover: Ductile-iron, 24" diameter cover, heavy-duty, indented top design, with 2" lettering cast into top reading "DRAIN" conforming with ASTM A48.

I. Brick: Comply with ASTM Standard Specification for "Sewer Brick (made from clay or shale)", Designation C32 for Grade SA.

J. Pipe Connectors: ASTM C 443 neoprene boot, 3/8-inch minimum thickness; or cement mortar, ASTM C 270, Type M. Use ASTM C 150, Type IIA cement., complying with ASTM C 923.

K. Cement mortar parging: ASTM c 150, Type IIA cement.

L. Precast concrete adjustment rings: Concrete minimum compressive strength of 5,000 psi at 28 days. Steel reinforcement to conform to ASTM A79, Grade 60 and have one inch minimum cover.

2.4 CATCH BASIN FRAMES AND GRATES

A. Catch basin frames and grates shall be of cast iron, three flange:

- LeBaron Foundry, Inc. Catalog No. LK 120A
- Neenah Foundry Catalog - R3589-A
- Sigma Corporation Catalog – FG-726

2.5 SLOTTED DRAIN

A. Slotted Drain shall have ADA compliant openings and shall be:

- 4" Polymax Standard Slot Drain System by Standard Park
- 4" Variable Height Slot Drain by Dura Trench
- ACO Drain type 470

PART 3 – EXECUTION

3.1 INSTALLATION OF PIPE AND PIPE FITTINGS

A. General: Install piping in accordance with municipal requirements, except where more stringent requirements are indicated.

B. Inspection and Acceptance of Pipe:

1. Acceptance will be on the basis of tests specified herein. The quality of all materials used in the pipe, the process of manufacture, and the finished pipe shall be subject to inspection by the Engineer. Inspection may be made at the place of manufacture, or on the work site after delivery or at both places and the pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though sample pipe units may have been accepted as satisfactory at the place of manufacture. The Contractor shall immediately remove all pipes that are rejected from the project site.

2. Installation shall be in accordance with ASTM D 2321, "Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications".

C. General Installation Requirements:
Thermoplastic pipe shall be unloaded and handled with reasonable care. Pipe shall be placed in the trench starting at the downstream end. Trenches must be excavated in such a manner as to insure that the sides will be stable under all working conditions. Trench walls shall be sloped or supported in conformance with all standards of safety. Only as much trench as can be safely maintained shall be opened. All trenches shall be backfilled as soon as practicable, but no later than the end of each working day.

D. Trench Widths:

Trench width shall be sufficient to ensure working room to properly and safely place and compact haunching and other backfill materials. Minimum trench width shall not be less than 1.25 times the pipe outside diameter plus 12 inches (1.25 x O.D. + 12-inches). If flowable fill is used, the trench width shall not be less than the outside diameter plus 12 inches (O.D. + 12-inches).

Note: On multiple pipe barrel runs the clear distance between pipes is as follows:

12-inches-24-inches Diameters: Clear span =12-inches

24-inches & Greater Diameter: Clear span = ½ x Diameter

E. Foundation and Bedding:

Foundation and bedding shall meet the requirements of AASHTO M 145, A-1, A-2-4, A-2-5, or A-3. A stable and uniform bedding shall be provided for the pipe and any protruding features of its joint and / or fittings. The middle of the bedding equal to 1/3rd of the pipe O.D. may be loosely placed, while the remainder shall be compacted to a

minimum 95% of maximum density per AASHTO T99. A minimum of 4-inch of bedding shall be provided prior to placement of the pipe, unless an unyielding material (rock cuts) is present in the trench bottom, then a 6-inch cushion of bedding is recommended. Bedding material size shall be 1.5 inch maximum granular material.

F. Structural Backfill:

Structural backfill shall also meet the requirements of AASHTO M 145, A-1, A-2-4, A-2-5, or A-3. Structural backfill shall be placed and compacted in layers 8-inch loose lift thickness and brought up evenly and simultaneously on both sides of the pipe to an elevation not less than one (1) foot above the top of the pipe. Structural backfill must be worked into the haunch area and compacted by hand. Structural backfill shall be 1.5-inch maximum granular size and a minimum compaction level of 95% Standard Proctor Density per AASHTO T99 shall be achieved.

G. Minimum Cover:

The minimum cover is one foot (1.0') for HS-25 Live Loads (4-inch-48-inch Diameters) and two (2.0) feet for larger diameter structures (60-inch Diameters). However, care should be taken when heavy construction equipment loads cross the pipe trench during construction. If the passage of construction equipment over an installed pipeline is necessary during project construction, compacted fill in the form of a ramp shall be constructed to a minimum elevation of three (3.0) feet over the top of the pipe. Any damaged pipe shall be replaced at the contractor's expense.

H. Joints:

Joints shall be installed that the connection of pipe sections will form a continuous line free from irregularities in the flow line. Suitable joints are the following:

1. Integral Bell-N-Spigot: The bell shall overlap a minimum of two (2) corrugations of the spigot end when fully engaged. The spigot end shall have an "O"-Ring gasket that meets ASTM F 477, "Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe".
2. Exterior Bell-N-Spigot: The bell shall be fully welded to the exterior of the pipe and overlap the spigot end so that flow lines and ends match when fully engaged. The spigot end shall have an "O"-Ring gasket that meets ASTM F 477, "Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe".

I. Flotation

Trenches should be dewatered, as necessary, to prevent flotation during pipe installation.

Following installation, flotation may also be a concern in areas which have low permeability native soil and/or a high-water table, or where Controlled Low Strength Material (CLSM) is to be used as a backfill material. In the event that these conditions will be encountered, please contact the pipe manufacturer for additional recommended guidance.

J. Velocity

A maximum velocity of twenty feet per second (20 fps) can be applied to HDPE pipe. For installations in which a velocity greater than this will be encountered, please contact the pipe manufacturer for additional information.

K. Pipe Storage: Pipe sections shall not be stored on areas over the newly laid pipe or other pipelines which might be damaged by the superimposed load, and storage sections shall be restricted to approved areas.

L. Handling Pipe: Each pipe unit shall be handled into its position in the trench only in such manner and by such means, as the Engineer accepts as satisfactory. The Contractor will be required to furnish suitable devices to permit satisfactory support of all parts of the pipe unit when it is lifted.

M. Laying Pipe: Except where a concrete cradle or envelope is required, the pipe shall be laid in a crushed stone cradle. In trenches, no blocking or supporting of the piping by concrete, stones, bricks, wooden wedges, or method other than bedding the pipe on crushed stone will be permitted. Each length of pipe shall be shoved home against the pipe previously laid and held securely in position. Joints shall not be "pulled" or "cramped" without approval of the Engineer.

N. Alignment and Placement: All pipes shall be laid with extreme care as to grade and alignment. Each pipe shall be so laid as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.

1. Stakeout of drain work and setting of line and grade is the responsibility of the Contractor.

2. Drain pipe shall be set true to line and grade using a laser beam aligner for grade. Pipe shall be laid carefully to grade. The laser beam projector is to be rigidly mounted with two (2) point suspension to its support platforms. This will assure that the effect of all ground equipment vibrations will be kept to a minimum and permit the laser beam to project itself coaxingly through the center of the pipe. All units must have equipment to control atmospheric conditions in the pipe that could affect the acceptable standard of construction. The laser alignment method selected must be shown to have worked satisfactorily on at least three contracts, and is operated by competent, trained personnel.

3. The Contractor shall establish centerline and offset stakes at each manhole, plus one intermediate centerline and offset stake as a check point between manholes. Laser aligning shall not be used to establish a continuous line in excess of 400 feet.

O. Cleaning: Care shall be taken to prevent earth, water and other materials from entering the pipeline. As soon as possible after the pipe and manholes are completed, the Contractor shall clean out the pipeline and manholes being careful to prevent soil, water and debris from entering any existing Drain.

1. Place plugs in end of uncompleted conduit at end of day or whenever work stops.

2. Flush lines between manholes if required to remove collected debris.

P. Inspection of Completed Storm Drain System: If the visual inspection of the completed drain or any part thereof shows any pipe, manhole, or joint to be of defective work or material the defect shall be replaced or repaired as directed. The visual inspection shall be conducted by the Engineer and any defects shall be as identified by such. The Contractor shall coordinate and provide site access for the Engineer.

3.2 INSTALLATION OF DRAIN MANHOLES

A. The bases shall be supported on a compacted level foundation of screened gravel at least 6-inches thick.

B. Manhole risers and tops shall be installed using approved butyl-rubber polymer type gasket or compressible joint filler for sealing joints of manhole risers and tops; jointing shall be performed in accordance with the manufacturer's recommendations. Manhole risers and tops shall be installed level and plumb. Water shall not be permitted to rise over newly made joints, nor until after inspection as to their acceptability. All jointing shall be done in a manner to insure watertight joints. Openings shall be provided in the precast concrete manhole risers to receive entering pipes and these openings shall be made at the place of manufacture. Connection of pipes to manholes shall be by means of a cement mortar joint.

C. Care shall be taken to assure that the openings are made to permit setting of the entering pipe at its correct elevation as indicated or directed. Manhole risers and tops shall be installed so that the manhole steps shall be in alignment.

D. All holes used for handling shall be thoroughly plugged with non-shrink grout.

E. Subsequent cutting or tampering in the field, for purpose of creating new openings or altering existing openings, will not be permitted except at the discretion of the Engineer.

3.3 SETTING MANHOLE FRAMES AND COVERS AND CATCH BASIN FRAMES AND GRATINGS

A. Manhole frames shall be set with tops conforming accurately to the grade of the pavement or finished ground surface or as indicated on the Drawings or as directed. Frames shall be set concentric with the top of the manhole on a maximum of five courses of brick and in a full bed of mortar so that the space between the top of the brick and mortar and the bottom flange of the frame shall be completely filled and made watertight. A thick ring of mortar extending to the outer edge of the concrete shall be placed all around the bottom flange. The mortar shall be smoothly finished to a height of 5-inches above the flange.

1. Only clean bricks shall be used in brick work to adjust frame elevations. The brick shall be moistened by suitable means.

2. Manhole covers shall be left in place in the frame until completion of other work at the manholes.

3. Frame castings for catch basins shall be set on a maximum of five courses of brick and in full mortar beds true to line and grade. Frames shall be set in a full bed or mortar and the cement mortar shall be brought up to a height of not less than 5-inches above the bottom of the frames. Where directed, the castings shall be temporarily set at such grades as to provide drainage during construction. The castings of structures located within the pavement area shall not be completely set to the established grade until the bottom course of pavement has been laid. The final setting of all other casting shall be performed at the proper stage of construction as directed.

3.4 BACKFILLING

A. General: Conduct backfill operations of open-cut trenches closely following laying, jointing, and bedding of pipe, and after initial inspection and testing are completed, all in accordance with Section 31 00 00 Earthwork.

END OF SECTION