SECTION 00 0101
PROJECT TITLE PAGE

PROJECT MANUAL

FOR

THE CHURCH OF JESUS CHRIST OF LATTER-DAY SAINTS
GARDEN CITY ASSEMBLY HALL

100 SOUTH PARADISE PARKWAY
GARDEN CITY, UTAH 84028

PREPARED BY:

DESIGN WEST ARCHITECTS

ARCHITECT’S PROJECT NUMBER: 218036

END OF SECTION
SECTION 00 0110

TABLE OF CONTENTS

DIVISION 00 -- PROCUREMENT AND CONTRACTING REQUIREMENTS
   00 0101 - Project Title Page
   00 0110 - Table of Contents
   00 2113 - Bidding Requirements
   00 7200 - General Conditions
   00 7300 - Supplementary Conditions

DIVISION 01 -- GENERAL REQUIREMENTS
   NOT USED

DIVISION 02 -- EXISTING CONDITIONS
   NOT USED

DIVISION 03 -- CONCRETE
   03 1000 - Concrete Forming and Accessories
   03 2000 - Concrete Reinforcing
   03 3000 - Cast-in-Place Concrete
   03 4500 - Precast Architectural Concrete

DIVISION 04 -- MASONRY
   04 2000 - Unit Masonry

DIVISION 05 -- METALS
   NOT USED

DIVISION 06 -- WOOD, PLASTICS, AND COMPOSITES
   06 1000 - Rough Carpentry
   06 1753 - Shop-Fabricated Wood Trusses
   06 2000 - Finish Carpentry
   06 4100 - Architectural Wood Casework

DIVISION 07 -- THERMAL AND MOISTURE PROTECTION
   07 2100 - Thermal Insulation
   07 2500 - Weather Barriers
   07 3113 - Asphalt Shingles
   07 6200 - Sheet Metal Flashing and Trim
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

07 7123 - Manufactured Gutters and Downspouts
07 9200 - Joint Sealants

DIVISION 08 -- OPENINGS
08 1113 - Hollow Metal Doors and Frames
08 4313 - Aluminum-Framed Storefronts
08 5313 - Vinyl Windows
08 7100 - Door Hardware
08 8100 - Glazing

DIVISION 09 -- FINISHES
09 2116 - Gypsum Board Assemblies
09 3000 - Tiling
09 6500 - Resilient Flooring
09 6816.01 - Sheet Carpet
09 9113 - Exterior Painting
09 9123 - Interior Painting

DIVISION 10 -- SPECIALTIES
10 2601 - Wall and Corner Guards
10 2800 - Toilet, Bath, and Laundry Accessories
10 4400 - Fire Protection Specialties
10 7430 - Alum Steeple

DIVISION 11 -- EQUIPMENT
11 3300 - Retractable Stairs

DIVISION 12 -- FURNISHINGS
NOT USED

DIVISION 13 -- SPECIAL CONSTRUCTION
NOT USED

DIVISION 14 -- CONVEYING EQUIPMENT
NOT USED

DIVISION 21 -- FIRE SUPPRESSION
21 1313 Wet-pipe Fire Sprinkler Systems

DIVISION 22 -- PLUMBING
22 0501 - Common Plumbing Requirements
22 0529 - Hangers and Supports for Plumbing Piping and Equipment
### TABLE OF CONTENTS

22 0553 - Identification for Plumbing Pipes and Equipment  
22 0719 - Plumbing Piping Insulation  
22 1116 - Domestic Water Piping  
22 1119 - Domestic Water Piping Specialties  
22 1313 - Facility Sewers  
22 1319 - Facility Sanitary Sewer Specialties  
22 3305 - Instantaneous, Tankless, Electric Domestic Water Heaters  
22 4213 - Commercial Water Closets and Urinals  
22 4216 - Commercial Lavatories and Sinks  
22 4700 - Drinking Fountains and Water Coolers  

**DIVISION 23 -- HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)**  
23 0501 - Common HVAC Requirements  
23 0529 - Hangers and Supports for HVAC Piping and Equipment  
23 0553 - Identification for HVAC Piping and Equipment  
23 0713 - Duct Insulation  
23 0719 - HVAC Piping Insulation  
23 0933 - Electric and Electronic Control System For HVAC  
23 1123 - Facility Gas Piping  
23 2300 - Refrigerant Piping  
23 2600 - Condensate Drain Piping  
23 3001 - Common Duct Requirements  
23 3114 - Low-Pressure Metal Ducts  
23 3300 - Air Duct Accessories  
23 3346 - Flexible Ducts  
23 3401 - Exhaust Fans  
23 3713 - Diffusers, Registers, And Grilles  
23 3714 - Louvers and Vents  
23 4100 - Air Filters  
23 5134 - Flues  
23 5417 - Gas-Fired Furnaces  
23 6214 - Compressor Units: Air Conditioning (5 Ton or Less)  
23 8216 - Air Coils: Dx  
23 8333 - Electric Radiant Heaters  

**DIVISION 26 -- ELECTRICAL**  
26 0519 - Low-voltage Electrical Power Conductors and Cables  
26 0526 - Grounding and Bonding for Electrical Systems  
26 0529 - Hangers and Supports for Electrical Systems  
26 0533 - Raceways and Boxes for Electrical Systems  
26 0544 - Sleeves and Sleeve Seals for Electrical Raceways and Cabling  
260548 - Vibration and Seismic Controls for Electrical Systems
DIVISION 26 -- ELECTRICAL SYSTEMS

26 0553 - Identification for Electrical Systems
26 0923 - Lighting Control Devices
26 0943 - Relay-based Lighting Controls
26 2416 - Panelboards
26 2713 - Electricity Metering
26 2726 - Wiring Devices
26 4113 - Lightning Protection for Structures
26 2816 - Enclosed Switches and Circuit Breakers
26 2913 - Enclosed Controllers
26 5100 - Interior Lighting
26 5600 - Exterior Lighting
26 8313 - Roof Snow Melt and Gutter De-Icing

DIVISION 27 -- COMMUNICATIONS

27 0526 – Grounding and Bonding for Communications Systems
27 0528 – Pathways for Communications Systems
27 1116 – Communications Cabinets, Racks, Frames, and Enclosures
27 1501 – Communications Horizontal Cabling
27 4117 – Video Systems
27 5117 – Audio Systems

DIVISION 28 -- ELECTRONIC SAFETY AND SECURITY

28 0528 - Pathways For Electronic Safety and Security
28 3111 - Digital, Addressible, Fire-Alarm System

DIVISION 31 -- EARTHWORK

31 2200 - EARTHWORK

DIVISION 32 -- EXTERIOR IMPROVEMENTS

32 1216 – Asphalt Concrete Paving
32 3113 – Chain Link Fences and Gates

DIVISION 33 -- UTILITIES

NOT USED

END OF SECTION
DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

00 0101 - Project Title Page
00 0110 – Table of Contents
00 2113 – Bidding Requirements
00 7200 – General Conditions Conditions
00 7300 – Supplementary Conditions
1. **GENERAL CONTRACTORS INVITED TO BID THE PROJECT:**

   DWA Construction  
   Dennis Darley  
   (435) 752-6860  
   dennis@dwaconstruct.com  
   76 West 2400 North  
   Logan, UT 84341

   J&H Thompson Construction  
   Henry Thompson  
   (435) 257-5793  
   j_hthompson@msn.com  
   4065 W 9600 N  
   Tremonton, UT 84337

   M and D and Sons Construction Co.  
   Jeremy Thompson  
   (435) 279-7582  
   jeremythompson1998@gmail.com  
   4735 W 10800 N  
   Tremonton, Utah 84337

   Saunders Construction  
   Craig Saunders  
   (801) 782-7830  
   craig@saunders1.com  
   1601 North 750 West,  
   Ogden, UT 84404

   Warner Construction  
   Joe Alldredge  
   (801) 794-0024  
   joe@warnerconst.com  
   1460 North Main #1A  
   Spanish Fork, UT 84660

2. **PROJECT:**

   Garden City Assembly Hall

3. **LOCATION:**

   100 South Paradise Parkway, Garden Cit UT 84028

4. **OWNER:**

   Corporation of the Presiding Bishop of  
   The Church of Jesus Christ of Latter-day Saints, a Utah corporation sole  
   c/o  
   Utah North PM/FM Office  
   435 N. Wall Ave., Ogden UT 84404

5. **CONSULTANT:**
6. DESCRIPTION OF PROJECT:
   A. The proposed project is for a new Assembly Hall. The building will consist of a 750 seat capacity assembly space, a serving area, restrooms, table/chair storage and entry vestibule areas. The asphalt parking area will accommodate 192 stalls, with additional gravel parking for oversized vehicles and overflow parking.
   B. Products or systems may be provided under a Value Managed Relationship (VMR) the Owner has negotiated with the supplier. VMR products and systems are indicated as such in the Specifications.

7. TYPE OF BID: Bids will be on a lump-sum basis. Segregated bids will not be accepted.

8. TIME OF SUBSTANTIAL COMPLETION: The time limit for substantial completion of this work will be 210 calendar days and will be as noted in the Agreement.

9. BID OPENING: Sealed bids will be received at 255 South 300 West, Logan UT 84321 on May 23, 2019 at 3:00pm. Bids will be publicly opened at 255 South 300 West, Logan UT 84321 on May 23, 2019 at 3:00pm.

10. BIDDING DOCUMENTS:
    A. Bidding Documents may be examined at the following plan room locations:
       1) Dodge Data and Analytics
       2) Mountainland Area Plan Room
       3)
       4)
    B. Bidding Documents may be obtained at the Architect’s office with a refundable deposit of $50.00 per set. Deposit will be refunded if documents are returned complete and in good condition within five days of bid opening.

11. BID BOND: Bid security in the amount of 5 percent (5%) of the bid will accompany each bid in accordance with the Instruction to Bidders.

12. BIDDER’S QUALIFICATIONS: Bidding by the General Contractors will be by invitation only.

13. OWNER’S RIGHT TO REJECT BIDS: The Owner reserves the right to reject any or all bids and to waive any irregularity therein.

END OF DOCUMENT
1. DEFINITIONS:

A. The definitions set forth in Section 1 of the General Conditions are applicable to the documents included under Bidding Requirements.

B. Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The proposed Contract Documents consist of the documents identified as Contract Documents in the Form of Agreement, except for Modifications. The Bidding Requirements are those documents identified as such in the proposed Project Manual.

C. Addenda are written or graphic documents issued by the Architect prior to execution of the Contract which modify or interpret the Bidding Documents. They become part of the Contract Documents as noted in the Form of Agreement upon execution of the Contract.

2. BIDDER'S REPRESENTATIONS:

A. By submitting a bid, the bidder represents that
   1) Bidder has carefully studied and compared the Bidding Documents with each other. Bidder understands the Bidding Documents and the bid is fully in accordance with the requirements of those documents,
   2) Bidder has thoroughly examined the site and any building located thereon, has become familiar with local conditions which might directly or indirectly affect the contract work, and has correlated its personal observations with the requirements of the proposed Contract Documents, and
   3) Bid is based on the materials, equipment, and systems required by the Bidding Documents without exception.

3. BIDDING DOCUMENTS:

A. Copies
   1) Bidding Documents may be obtained as set forth in the Invitation to Bid.
   2) Partial sets of Bidding Documents will not be issued.
   3) Bidders will use complete sets of Bidding Documents in preparing bids and make certain that those submitting sub-bids to them have access to all portions of the documents that pertain to the work covered by sub-bid, including General Conditions, Supplementary Conditions, and Division 01. Bidder assumes full responsibility for errors or misinterpretations resulting from use of partial sets of Bidding Documents by itself or any sub-bidder.

B. Interpretation or Correction of Bidding Documents
   1) Bidders will request interpretation or correction of any apparent errors, discrepancies and omissions in the Bidding Documents.
   2) Corrections or changes to Bidding Documents will be made by written addenda.

C. Substitutions and Equal Products
   1) Generally speaking, substitutions for specified products and systems, as defined in the Uniform Commercial Code, are not acceptable. However, equal products may be approved upon compliance with Contract Document requirements.
   2) The terms ‘Acceptable Manufacturers’, ‘Approved Manufacturers ‘Suppliers’, ‘Installers’ and ‘VMR (Value Managed Relationship) Manufacturers / Suppliers / Installers’ are used throughout the Project Manual to differentiate among the options available to Contractor regarding specified products, manufacturers, and suppliers. See Section 016000 for options available regarding acceptance of equal products.
   3) Base bid only on materials, equipment, systems, suppliers or performance qualities specified in the Bidding Documents.
4) Architect is only authorized to consider requests for approval of equal products to replace specified products in Sections where the heading 'Acceptable Manufacturers' is used and statement, 'Equal as approved by Architect before bidding. See Section 016000' or 'Equal as approved by Architect before installation. See Section 016000,' appears. In Sections where the afore-mentioned statements do not appear and a different heading is used, Architect is authorized as Owner's representative to decline consideration of requests for approval of equal products. Approvals of equal products in such Sections must be made by Owner and will generally be for subsequent Projects.

D. Addenda - Addenda will be sent to bidders and to locations where Bidding Documents are on file no later than one week prior to bid opening or by fax no later than 48 hours prior to bid opening.

4. BIDDING PROCEDURES:

A. Form and Style of Bids
   1) Use Owner's Bid Form.
   2) Fill in all blanks on Bid Form. Signatures will be in longhand and executed by representative of bidder duly authorized to make contracts.
   3) Bids will bear no information other than that requested on bid form. Do not delete from or add to the information requested on the bid form.

B. Bid Security
   1) Each bid will be accompanied by a bid bond naming Owner, as listed in the Agreement, as obligee. If Bidder refuses to enter into a Contract or fails to provide bonds and insurance required by the General Conditions, amount of bid security will be forfeited to Owner as liquidated damages, not as a penalty.
   2) Bid bond will be issued by a surety company meeting requirements of the General Conditions for surety companies providing bonds and will be submitted on AIA Document A310, Bid Bond or AIA authorized equivalent provided by surety company. The attorney-in-fact who executes the bond on behalf of the surety will affix to the bond a certified and current copy of the power of attorney.
   3) Owner may retain bid security of bidders to whom an award is being considered until -
      a. Contract has been executed and bonds have been furnished,
      b. Specified time has elapsed so bids may be withdrawn, or
      c. All bids have been rejected.

C. Submission of Bids
   1) Submit bid in sealed opaque envelope containing only bid form and bid security. Envelopes will be sealed, bear bidder's name, and include the following:

   BID FOR

   ________ (Project Name) ________
   ________ (number) ________

   If bid is sent by mail, enclose sealed envelope in separate mailing envelope with notation 'SEALED BID ENCLOSED' on face.
   2) It is bidder's sole responsibility to see that its bid is received at specified time. Bids received after specified bid opening time will be returned to bidders unopened.
   3) No oral, facsimile transmitted, telegraphic, or telephonic bids, modifications, or cancellations will be considered.

D. Modification or Withdrawal of Bid
   1) Bidder guarantees there will be no revisions or withdrawal of bid amount for 45 days after bid opening.
   2) Prior to bid opening, bidders may withdraw bid by written request or by reclaiming bid envelope.
   3) Prior to bid opening, bidder may mark and sign on the sealed envelope that bidder
5. CONSIDERATION OF BIDS:

A. Opening of Bids - See Invitation to Bid.

B. Rejection of Bids - Owner reserves right to reject any or all bids and to waive any irregularity therein.

C. Acceptance of Bid
   1) No bidder will consider itself under contract after opening and reading of bids until Agreement between Owner and Contractor is fully executed.
   2) Bidder's past performance, organization, subcontractor selection, equipment, and ability to perform and complete its contract in manner and within time specified, together with amount of bid, will be elements considered in award of contract.

6. POST-BID INFORMATION:

A. The conditionally accepted bidder submitting a bid involving subcontractors will submit its list of proposed subcontractors in a meeting to be held immediately after bid opening.

7. PERFORMANCE BOND AND PAYMENT BOND:

A. Bond Requirements - Performance Bond and Labor and Material Payment bond will be required for this Project as specified in the General Conditions.

B. Time of Delivery of Bonds - Bonds will be delivered to Owner with Agreement signed by bidder.

8. FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR:

A. Agreement form will be “Agreement Between Owner and Contractor for a Fixed Sum (U.S.)” provided by Owner.

9. MISCELLANEOUS:

A. Pre-Bid Conference
   1) A pre-bid conference will be held at a time and place to be announced.

B. Liquidated Damages - Conditions governing liquidated damages are specified in the General Conditions and in the Supplementary Conditions.

C. Examination Schedule for Existing Building and Site
   1) May 9, 2019 at 9:00am

D. Exemption from local taxes - See Supplementary Conditions

END OF DOCUMENT
1. GEOTECHNICAL DATA
   A. Geotechnical Report -
      1) Owner has secured the services of a geotechnical engineer to aid in design of the Project. Following conditions apply -
         a) A geotechnical report has been prepared by GHS, referred to as the Geotechnical Engineer.
         b) A copy of this report will be issued to each invited Contractor.
         c) This report was obtained solely for use in design by Consultant and is not a part of the Contract Documents. It is not intended that Contractor rely on geotechnical engineer’s report.
         d) Reports are provided for Contractor’s information but are not a warranty of subsurface conditions.
      2) Prior to bidding, Contractor may make his own subsurface investigations to satisfy himself with site and subsurface conditions.

2. ASBESTOS-CONTAINING MATERIAL (ACM)
   A. The building upon which work is being performed has been examined for asbestos-containing material. The following have been identified as containing asbestos in the areas of the building being worked on as part of this Project:
      1) N/A
   B. Refer to Section N/A, Article for requirements to be followed.

END OF DOCUMENT
SUBCONTRACTORS AND MAJOR MATERIALS SUPPLIERS LIST

Project Name: ____________________________  Date: _________________________

Stake: ____________________________  Project No: ____________________________

General Contractor: ___________________________________________________________

General Contractor is to provide the names of the following subcontractors and suppliers to the Owner’s Project Manager immediately following the bid opening:

VMR SUBCONTRACTORS

Roofing ________________________________________________________________

Doors, Frames & Hardware _________________________________________________

Storefronts ______________________________________________________________

Wood Flooring ___________________________________________________________

Other ____________________________________________________________________

Other ____________________________________________________________________

SUBCONTRACTORS AND SUPPLIERS

Grading / Site work _________________________________________________________

Site Utilities _____________________________________________________________

Demolition _______________________________________________________________

Paving _________________________________________________________________

Termite Control _________________________________________________________

Site Concrete ___________________________________________________________

Fencing _________________________________________________________________

Irrigation System _________________________________________________________

Landscaping _____________________________________________________________

Building Concrete _______________________________________________________
Masonry

Structural Steel

Framing

Trusses

Insulation

EIFS

Soffit / Fascia

Steeple

Millwork

Drywall

Ceramic Tile

Acoustical Tile

Painting

Wall Coverings

Elevators / Lifts

Draperies

Fire Sprinklers

Plumbing

HVAC

Electrical

Controls

Sound / Satellite
A proposed product is not legally approved and cannot legally be included in a bid or used in the Work until it appears in an Addendum or other Contract Modification as defined in the General Conditions. See Instructions To Bidders Paragraph 3.C, General Conditions, and Section 016000.

PROPOSED EQUAL PRODUCT:

Specification Section: ______________________

Specified Products: ______________________

Proposed Product: ______________________

The Undersigned certifies:
1. Proposed equal product has been fully investigated and determined to be equal or superior in all respects to specified products.
2. Same warranty will be furnished for proposed equal product as for specified products.
3. Same maintenance service and source of replacement parts, as applicable, is available.
4. Proposed equal product will have no adverse effect on other trades and will not affect or delay progress schedule.
5. Proposed equal product does not affect dimensions and functional clearances.

ATTACHMENTS:

Include the following attachments -
1. Copy of the Project Manual Section where the proposed equal product would be specified, rewritten or red-lined to include any changes necessary to correctly specify the proposed equal product. Identify completely changes necessary to the original Project Manual Section.
2. Copies of details, elevations, cross-sections, and other elements of the Project Drawings redone as necessary to show changes necessary to accommodate proposed equal product. Identify completely the changes from the original Drawings.
3. Complete product literature and technical data, installation and maintenance instructions, test results, and other information required to show complete conformance with requirements of the Contract Documents.

SIGNED: __________________________________________

Printed Name ______________________________________

Company _________________________________________

Address _________________________________________

City, State, Zip Code ________________________________

Telephone ____________________ Fax ___________________
REVIEW COMMENTS:

_____ Accepted. See Addenda Number _____.

_____ Submission not in compliance with instructions. Respond to attached comments and resubmit.

_____ Proposed equal product not acceptable. Use specified products.

_____ Not Reviewed. Submission received too late. Use specified products.

________________________________________________________

ADDITIONAL COMMENTS:

________________________________________________________________________________________

BY: ______________________________________ DATE: ________________________________
BID FORM
FOR GENERAL CONTRACT WORK (U.S.)

PROJECT IDENTIFICATION:

OWNER:
Corporation of the Presiding Bishop of the Church of Jesus Christ of Latter-day Saints, a Utah corporation sole ("Owner")

ARCHITECT:
Design West Architects

BID

1. In submitting this Bid, Bidder represents that:
   a. If this Bid is accepted, Bidder will enter into an agreement with Owner to perform and furnish the Work described in the Bidding Documents for the Bid Price and within the Time of Substantial Completion indicated in this Bid and in accordance with the other terms and conditions of the Contract Documents.
   b. Bidder has carefully examined Set(s) Number _______ of the Bidding Documents consisting of the Project Manual containing the Bidding Requirements, the Conditions of the Contract, and the Specifications, entitled ________________________, the Drawings entitled ________________________, and dated ________________________, and including sheets numbered ________________________, and addenda numbers ________________________.
   c. Bidder has examined the site of the work, existing conditions, and all other conditions affecting the work on the above-named Project.
   d. Bidder has carefully correlated the information known to Bidder and information and observations obtained from visits to the site with the Bidding Documents.
   e. Bidder is familiar with federal, State, and local laws and regulations applicable to Project.
   f. Bidder guarantees there will be no revisions or withdrawal of bid amount for forty-five (45) days after the bid opening.

2. Bidder hereby proposes to furnish all materials, labor, equipment, tools, transportations, services, licenses, fees, permits, etc., required by said documents to complete the Work described by the Contract Documents for the lump-sum of: ________________________________ Dollars ($ ________________________).

3. Bidder agrees to achieve substantial completion of the Work within the number of days indicated in the Invitation to Bid.

4. Enclosed is a Bid Bond for not less than five percent (5%) of the bid.

RESPECTFULLY SUBMITTED:

__________________________________
Signature

__________________________________
Printed name

__________________________________
Title

__________________________________
Company name

__________________________________
Business Address

__________________________________
Date

_______________________________
City, State, and Zip Code

__________________________________
License No.

_______________________________
Telephone

_______________________________
Fax

_______________________________
Contact Email Address
CONSTRUCTION MATERIAL ASBESTOS STATEMENT (U.S.)

PROJECTS FOR:
CORPORATION OF THE PRESIDING BISHOP OF
THE CHURCH OF JESUS CHRIST OF LATTER-DAY SAINTS

<table>
<thead>
<tr>
<th>Building Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Building Plan Type:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Building Address:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Building Owner:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporation of the Presiding Bishop of The Church of Jesus Christ of Latter-day Saints, a Utah corporation sole.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project Number:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Completion Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

As PROJECT CONSULTANT and principal in charge; based on my best knowledge, information, inspection, and belief; I certify that on the above referenced Project, no asbestos-containing building materials were specified in the construction documents or given approval in shop drawings or submittals.

Project Consultant and Principal in Charge (signature)  Date

Company Name

As GENERAL CONTRACTOR in charge of construction; based on my best knowledge, information, inspection, and belief; I affirm that on the above-referenced Project, no asbestos-containing building materials were used in the construction.

General Contractor (signature)  Date

Company Name
GENERAL CONDITIONS
For a Fixed Sum (U.S.)

SECTION 1 GENERAL PROVISIONS

1.1 DEFINITIONS

A. Adverse Weather: weather conditions that are seasonally abnormal and could not have been reasonably anticipated.


C. Architect: the entity identified as such in the Agreement.

D. Change In The Work: a modification to the requirements of the Contract Documents or a delay in Substantial Completion resulting from an instruction from Owner or Architect to Contractor or from another event or circumstance.

E. Change Order: a written instrument prepared by Architect and signed by Owner, Contractor, and Architect stating their agreement upon the following: (1) the occurrence of a Change in the Work; (2) the amount of the adjustment, if any, in the Contract Sum as a result of the Change in the Work; and (3) the extent of the adjustment, if any, in the Contract Time as a result of the Change in the Work.

F. Construction Change Directive: a written order prepared by Architect and signed by Architect and Owner which: (1) orders a Change in the Work if the terms of a Change Order cannot be agreed upon prior to performance of a Change in the Work described in Section 7.1 or after occurrence of an event or circumstance described in Section 7.2; and (2) states a proposed basis for adjustment, if any, in the Contract Sum, the Contract Time, or both, resulting from the Change in the Work.

G. Contract Documents: the documents identified as such in the Agreement.

H. Contract Sum: the total amount set forth in the Agreement payable by Owner to Contractor for performance of the Work.


J. Contractor: the entity identified as such in the Agreement.

K. Day: calendar day unless otherwise specifically defined.

L. Direct Costs: actual costs for labor, materials, equipment, insurance, bonds, subcontract costs and onsite supervision relating to the Project. They do not include labor costs for project managers or other off-site administration.

M. Drawings: the documents identified as such in the Agreement.

N. Field Change: a written order prepared by Architect and signed by Architect and Contractor for a minor Change in the Work consistent with the general intent of the Contract Documents costing $1,000 or less, resulting in no time extension, and which is necessary to avoid delaying the Work.

O. Modification: a written amendment to the Contract Documents in the form of a:
   1. Change Order;
   2. Construction Change Directive; or
   3. Field Change.

P. Owner: the entity identified as such in the Agreement.

Q. Project: the total construction designed by Architect of which the Work performed under the Contract Documents may be the whole or a part.
R. **Product Data:** standard illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information furnished by Contractor to illustrate details regarding materials or equipment to be used in the Work, or the manner of installation, operation, or maintenance of such materials or equipment.

S. **Project Manual:** the document identified as such in the Agreement.

T. **Samples And Mock-ups:** physical examples that illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged.

U. **Shop Drawings:** drawings, diagrams, illustrations, schedules, performance charts, fabrication and installation drawings, setting diagrams, patterns, templates, and other data which illustrate some portion of the Work and confirm dimensions and conformance to the Contract Documents specially prepared by Contractor or any Subcontractor, manufacturer, supplier, or distributor.

V. **Specifications:** the documents identified as such in the Agreement.

W. **Subcontractor:** any entity supplying labor, materials, equipment, construction or services for the Work under separate contract with Contractor or any other Subcontractor.

X. **Submittals:** Shop Drawings, Product Data, Samples and Mock-ups and any other documents or items furnished by Contractor or its Subcontractors to Owner or Architect to demonstrate how any portion of the Work will be accomplished or the type of materials or products that will be used in the Work.

Y. **Substantial Completion:** Completion of the Work to a point where Owner can use the Work for its intended purposes. The date of Substantial Completion is the date certified as such by Architect in accordance with the Contract Documents.

Z. **Work:** all labor, materials, equipment, construction, and services required by the Contract Documents.

AA. **Written Notice:** notice in writing given from one party to the other at the addresses or facsimile numbers listed in the Agreement, or at such other addresses or facsimile numbers as the parties will designate from time to time by Written Notice, and will be effective at the earliest of:
1. The date of personal delivery to the other party with signed acknowledgment of receipt; or
2. The date sent by facsimile transmission to the other party provided receipt of the facsimile is verified by an electronic confirmation report by the party sending the facsimile transmission and further provided that a confirmation copy is sent to the other party by courier or by registered or certified mail within twenty-four (24) hours after the time and date of the facsimile transmission; or
3. The date of receipt by the other party as stated on the return receipt if sent by registered or certified mail, or by courier.

1.2 **CORRELATION AND INTENT OF CONTRACT DOCUMENTS**

A. The intent of the Contract Documents is to require Contractor to provide all labor, materials, equipment, construction, and services necessary for the proper execution and completion of the Work. The Contract Documents are complementary and what is required by any one will be as binding as if required by all. Contractor will perform the Work in accordance with the requirements expressly set forth in or reasonably inferable from the Contract Documents.

B. The organization of the Contract Documents is not intended to control Contractor in dividing the Work among Subcontractors or to establish the extent of the Work to be performed by any trade.

C. Words used in the Contract Documents that have well known technical or trade meanings are used therein in accordance with such recognized meanings.

D. In the interest of brevity, the Contract Documents may omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

1.3 **OWNERSHIP AND USE OF CONTRACT DOCUMENTS**

The Drawings, the Project Manual, and copies thereof are the property of Owner. Contractor will not use these documents on any other project. Contractor may retain one copy of the Drawings and the Project Manual as a contract record set and will return or destroy all remaining copies following final completion of the Work.

1.4 **PUBLIC STATEMENTS REGARDING PROJECT**

Contractor will not make any statements or provide any information to the media about the Project without the prior written consent of Owner. If Contractor receives any requests for information from media, Contractor will refer such requests to Owner.

1.5 **OWNERSHIP AND USE OF RENDERINGS AND PHOTOGRAPHS**

Renderings representing the Work are the property of Owner. All photographs of the Work, whether taken during performance of the Work or at completion, are the property of the Owner. The Owner reserves all rights including copyrights to renderings and photographs of the Work. No renderings or photographs shall be used or distributed without written consent of the Owner.
1.6 NO COMMERCIAL USE OF TRANSACTION OR RELATIONSHIP

Without the prior written consent of Owner, which Owner may grant or withhold in its sole discretion, neither Contractor nor Contractor’s affiliates, officers, directors, agents, representatives, shareholders, members, Subcontractors, Sub-subcontractors or employees shall make any private commercial use of their relationship to Owner or the Project, including, without limitation:

A. By referring to this Agreement, Owner, or the Project verbally or in any sales, marketing or other literature, letters, client lists, press releases, brochures or other written materials except as may be necessary for Contractor to perform Contractor’s obligations under the terms of this Agreement;

B. By using or allowing the use of any photographs of the Project or any part thereof, or of any service marks, trademarks or trade names or other intellectual property now or which may hereafter be associated with, owned by or licensed by Owner in connection with any service or product; or

C. By contracting with or receiving money or anything of value from any person or commercial entity to facilitate such person or entity obtaining any type of commercial identification, advertising or visibility in connection with the Project.

Notwithstanding the foregoing, Contractor may include a reference to Owner and the services and equipment provided under this Agreement in a professional résumé or other similar listing of Contractor’s references without seeking Owner’s written consent in each instance; provided, that such reference to Owner, the services and equipment is included with at least several other similar references and is given no more prominence than such other references.

1.7 CONFIDENTIALITY / PROPERTY RIGHTS

A. Owner will retain ownership and intellectual property rights in all plans, designs, drawings, documents, concepts, and materials provided by or on behalf of Owner to Contractor and to all work products of Contractor for or relative to Work performed under this Agreement, such products, services, and Work of Contractor constituting works made for hire. Contractor will not reuse any portions of such items provided by Owner or developed by Contractor for Owner pursuant to this Agreement, or disclose any such items to any third party without the prior written consent of Owner. Owner may withhold its consent in its’ absolute discretion.

B. In addition, Contractor shall ensure that Contractor, Subcontractors, and the employees, agents and representatives of Contractor and its Subcontractors maintain in strict confidence, and shall use and disclose only as authorized by Owner all Confidential Information of Owner that Contractor receives in connection with the performance of this Agreement. Notwithstanding the foregoing, Contractor may use and disclose any information to the extent required by an order of any court or governmental authority, but only after it has notified Owner and Owner has had an opportunity to obtain reasonable protection for such information in connection with such disclosure. For purposes of this Agreement, “Confidential Information” means:
1. The name or address of any affiliate, customer or contractor of Owner or any information concerning the transactions of any such person with Owner;
2. Any information relating to contracts, agreements, business plans, budgets or other financial information of Owner to the extent such information has not been made available to the public by the Owner; and
3. Any other information that is marked or noted as confidential by the Owner at the time of its disclosure.

1.8 COMPLY WITH INTELLECTUAL PROPERTY RIGHTS OF OTHERS

Contractor represents and warrants that no Work (with its means, methods, goods, and services attendant thereto), provided to Owner will infringe or violate any right of any third party and that Owner may use and exploit such Work, means, methods, goods, and services without liability or obligation to any person or entity (specifically and without limitation, such Work, means, methods, goods, and services will not violate rights under any patent, copyright, trademark, or other intellectual property right or application for the same).

SECTION 2 - OWNER

2.1 OWNER’S DESIGNATED REPRESENTATIVE

Owner will designate in writing a representative who will have express authority to bind Owner with respect to all matters requiring Owner’s approval or authorization.

2.2 INFORMATION AND SERVICES REQUIRED OF OWNER

A. Owner will be responsible for establishment of property lines and benchmarks for grading.

B. Owner will furnish to Contractor any information or services it is required to furnish under the Contract Documents with reasonable promptness to avoid delay in the orderly progress of the Work.

C. Owner will furnish to Contractor a reasonable number of copies of the Drawings, the Project Manual, and the Addenda.

2.3 OWNER’S RIGHT TO INSPECT THE WORK

Owner and its representatives will have the right to inspect any portion of the Work wherever located at any time.

2.4 OWNER’S RIGHT TO STOP THE WORK
3.2 SUPERVISION OF CONSTRUCTION PROCEDURES

A. Contractor will supervise and direct the Work. Contractor will be solely responsible for all construction means, methods, techniques, sequences, and procedures and for coordinating all portions of the Work. All loss, damage, liability, or cost of correcting defective work arising from the use of any construction means, methods, techniques, sequences or procedures will be borne by Contractor, notwithstanding that such construction means, methods, techniques, sequences or procedures are referred to, indicated or implied by the Contract Documents, unless Contractor has given timely notice to Owner and Architect in writing that such means, methods, techniques, sequences or procedures are not safe or suitable, and Owner has then instructed Contractor in writing to proceed at Owner’s risk.

B. Contractor will utilize its best skill, efforts, and judgment to provide efficient business administration and supervision, to furnish at all times an adequate supply of workers and materials, and to perform the Work in an expeditious and economical manner consistent with the interests of Owner.

C. Contractor will be responsible for:
   1. The proper observance of property lines and set back requirements as shown in the Contract Documents;
2. The location and layout of the Work as shown in the Contract Documents with respect to the position of the Work on the property and the elevation of the Work in relation to grade; and
3. Setting and maintaining construction stakes.

D. Contractor will be responsible to Owner for the acts and omissions of its employees and Subcontractors as well as persons either directly or indirectly employed by Subcontractors.

E. Contractor will not be relieved of its obligation to perform the Work in accordance with the Contract Documents as a result of any tests, inspections, or approvals by Owner, Architect or their consultants.

F. Contractor will be responsible for inspection of portions of the Work already completed to determine that such portions are in proper condition to receive subsequent portions of the Work.

G. Contractor recognizes that the Project site and the surrounding area is frequently visited by the public and is important to Owner’s image and function and will maintain the premises free from debris and waste materials resulting from Construction. At the completion of Construction, Contractor shall promptly remove construction equipment, tools, surplus materials, waste materials and debris.

3.3 LABOR AND MATERIALS

A. Unless otherwise provided in the Contract Documents, Contractor will provide and pay for all labor, materials, equipment, tools, water, heat, utilities, transportation, and other facilities and services necessary for the proper execution and completion of the Work.

B. Contractor will at all times enforce strict discipline and good order among those performing the Work and will not permit employment of any unfit person or anyone not skilled in the tasks assigned to them.

C. Contractor is fully responsible for the Project and all materials and work connected therewith until Owner has accepted the Work in writing. Contractor will replace or repair at its own expense any materials or work damaged or stolen, regardless of whether it has received payment for such work or materials from the Owner.

D. Contractor will remedy all damage or loss to any property caused in whole or in part by Contractor, any Subcontractor, or by anyone for whose acts any of them may be liable.

E. Contractor will be responsible for determining that all materials furnished for the Work meet all requirements of the Contract Documents. Architect may require Contractor to produce reasonable evidence that a material meets such requirements, such as certified reports of past tests by qualified testing laboratories, reports of studies by qualified experts, or other evidence which, in the opinion of Architect, would lead to a reasonable certainty that any material used, or proposed to be used, in the work meets the requirements of the Contract Documents. All such data will be furnished at Contractor’s expense. This provision will not require Contractor to pay for periodic testing of different batches of the same material, unless such testing is specifically required by the Contract Documents to be performed at Contractor’s expense.

F. Contractor will coordinate and supervise the work performed by Subcontractors so that the Work is carried out without conflict between trades and so that no trade, at any time, causes delay to the general progress of the Work. Contractor and all Subcontractors will at all times afford each trade, any separate contractor, or Owner, reasonable opportunity for the installation of Work and the storage of materials.

G. Contractor warrants to Owner that the materials and equipment furnished for the Work will be new unless otherwise specified by the Contract Documents, and that the Work will be free from defects, and will conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective in the discretion of Owner. If required by Architect, Contractor will furnish satisfactory evidence as to the kind and quality of the materials and equipment used in performing the Work.

H. Owner may elect to purchase materials required for the Work. In that event, Contractor will comply with the procedures set forth in the Contract Documents relating to such materials.

3.4 COMPLIANCE WITH LAWS

Contractor will comply with all applicable laws, ordinances, rules, regulations, and orders of any public authorities relating to performance of the Work.

3.5 TAXES

A. Contractor will pay all sales, use, consumer, payroll, workers compensation, unemployment, old age pension, surtax, and similar taxes assessed in connection with the performance of the Work.

B. Owner will pay all taxes and assessments on the real property comprising the Project site.

3.6 PERMITS AND FEES

A. Owner will obtain and pay for all zoning and use permits and permanent easements necessary for completion of the Work.
B. Contractor will obtain and pay for the building permit, and all other permits, governmental fees, licenses and inspections necessary for the proper execution and completion of the Work.

C. Contractor will secure any certificates of inspection and of occupancy required by authorities having jurisdiction over the Work. Contractor will deliver these certificates to Architect prior to issuance of the Certificate of Substantial Completion by Architect.

3.7 CONTRACTOR'S ON-SITE REPRESENTATIVE

Contractor will employ a competent representative acceptable to Owner to supervise the performance of the Work. This representative will be designated in writing by Contractor prior to commencement of work and will not be changed prior to final inspection of the Work without prior written consent of Owner. This representative will represent Contractor for all purposes, including communication with Owner.

3.8 CONTRACTOR'S CONSTRUCTION SCHEDULES

A. Contractor will prepare and submit for Owner's and Architect's information Contractor's construction schedule for the Work in accordance with the requirements of the Contract Documents.

B. Contractor will prepare and maintain a Submittal schedule which is coordinated with Contractor's construction schedule and sets forth specified times for Architect to review Submittals.

3.9 DOCUMENTS AND SUBMITTALS AT THE SITE

Contractor will keep at the Project site for use by Owner, Architect, or their representatives, a record copy of the Project Manual, the Drawings, all Addenda, and all Modifications. These documents will be maintained in good order and currently marked to record changes and selections made during construction. In addition, Contractor will keep at the Project site one copy of all Submittals.

3.10 SUBMITTALS

A. Submittals are not Contract Documents and do not alter the requirements of the Contract Documents unless incorporated into the Contract Documents by a Modification.

B. Contractor will review, approve, and submit to Architect Submittals in accordance with the Contract Documents. By approving Submittals, Contractor represents that it has determined and verified field measurements, field construction criteria, materials, catalog numbers, and similar data, and that it has checked and coordinated each Submittal with the requirements of the Work and of the Contract Documents or will make such determination, verification, check, and coordination prior to commencing the relevant portion of the Work. In reviewing Submittals Architect will be entitled to rely upon Contractor's representation that such information is correct and accurate.

C. Contractor will inform Architect in writing at the time of submission of any Submittal or portion thereof which deviates from the requirements of the Contract Documents. Contractor will provide Architect with documentation demonstrating to Architect that the Submittal is equal to or better than the specified product or work. Contractor will not be relieved of responsibility for deviations from the requirements of the Contract Documents by Architect's acceptance of a Submittal unless Contractor has informed Architect in writing of the deviation and Architect has incorporated the deviation into the Contract Documents by a Modification.

D. Contractor will not perform any portions of the Work requiring Submittals until the respective Submittal has been reviewed and accepted in writing by Architect.

E. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, Owner will be entitled to rely upon such certifications, and neither Owner nor Architect will be expected to make any independent examination with respect thereto.

F. Submittals not required by the Contract Documents may be returned to Contractor without action.

3.11 CUTTING AND PATCHING

Contractor will be responsible for any cutting, fitting, and patching that may be required to complete the Work and make its parts fit together properly.

3.12 ACCESS TO WORK

Contractor will permit Owner, Architect, their representatives and consultants, access to the Work wherever located at any time.

3.13 ROYALTIES AND PATENTS

Contractor will pay all royalties and license fees required by the Work or by Contractor's chosen method of performing the Work. Contractor will defend and hold Owner harmless from all suits or claims for infringement of any patent, license or other intellectual property rights or any loss on account thereof.

3.14 INDEMNIFICATION
A. Contractor will indemnify and hold harmless Owner and Owner's representatives, employees, agents, architects, and consultants from and against any and all claims, damages, liability, demands, costs, judgments, awards, settlements, causes of action, losses and expenses (collectively "Claims" or "Claim"), including but not limited to attorney fees, consultant fees, expert fees, copy costs, and other expenses, arising out of or resulting from performance of the Work, attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of real or personal property, including loss of use resulting therefrom, except to the extent that such liability arises out of the negligence of Owner, its representatives, agents, and employees. This indemnity includes, without limitation, indemnification of Owner from all losses or injury to Owner's property, except to the extent that such loss or injury arises out of the negligence of Owner, its representatives, agents, and employees. This indemnity applies, without limitation, to include Claims occurring both during performance of the Work and/or subsequent to completion of the Work. In the event that any Claim is caused in part by a party indemnified hereunder, that party will bear the cost of such Claim to the extent it was the cause thereof. In the event that a claimant asserts a Claim for recovery against any party indemnified hereunder, the party indemnified hereunder may tender the defense of such Claim to Contractor. If Contractor rejects such tender of defense and it is later determined that the negligence of the party indemnified hereunder did not cause all of the Claim, Contractor will reimburse the party indemnified hereunder for all costs and expenses incurred by that party in defending against the Claim. Contractor will not be liable hereunder to indemnify any party for damages resulting from the sole negligence of that party.

B. In addition to the foregoing, Contractor will be liable to defend Owner in any lawsuit filed by any Subcontractor relating to the Project. Where liens have been filed against Owner's property, Contractor (and/or its bonding company which has issued bonds for the Project) will obtain lien releases and record them in the appropriate county and/or local jurisdiction and provide Owner with a lien free and clear from any liens of Subcontractors. In the event that Contractor and/or its bonding company are unable to obtain a lien release, Owner in its absolute discretion may require Contractor to provide a bond around the lien or a bond to discharge the lien, at Contractor's sole expense.

C. In addition to the foregoing, Contractor will indemnify and hold Owner harmless from any claim of any other contractor resulting from the performance, nonperformance or delay in performance of the Work by Contractor.

D. The indemnification obligation herein will not be limited by a limitation on the amount or type of damages, compensation or benefits payable by or for Contractor or a Subcontractor under worker's compensation acts, disability benefit acts, or other employee benefit acts.

3.15 PROJECT MEETINGS

Contractor will attend and participate in meetings as required by the Contract Documents.

SECTION 4 - ADMINISTRATION OF THE CONTRACT

4.1 ARCHITECT

In the event that Owner terminates its contractual relationship with Architect, Owner will appoint in writing another architect, whose status under the Contract Documents will be that of the former Architect in all respects.

4.2 ARCHITECT'S ADMINISTRATION OF THE CONTRACT

A. Architect will make periodic visits to the site to familiarize itself generally with the progress and quality of the Work and to determine if the Work is proceeding in accordance with the Contract Documents. Although Architect is required to make periodic inspections, it is not required to make exhaustive or continuous onsite inspections. On the basis of its observations while at the site, Architect will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defects and deficiencies in the Work. Architect's failure to observe a defect or deficiency in the Work will not relieve Contractor of its duty to perform the Work in accordance with the Contract Documents.

B. Architect will review Contractor's payment requests and determine the amounts due Contractor in accordance with Section 9.

C. Communications between Contractor and Owner relating to the Work will be through Architect. Communications between Owner or Contractor with Architect's consultants relating to the Work will be through Architect. Communications between Owner or Architect and subcontractors relating to the Work will be through Contractor. Communications between Contractor and any separate contractor will be through Architect, except as otherwise specified in the Contract Documents.

D. Owner and/or Architect will have the right to reject and require removal of the following at Contractor's expense:
   1. Any portion of the Work that does not meet the requirements of the Contract Documents.
   2. Any portion of the Work damaged or rendered unsuitable during installation or resulting from failure to exercise proper protection.

E. Architect will have authority to suspend the Work, with concurrence of Owner, whenever such suspension may be necessary in its reasonable opinion to insure the proper performance of the Work.

F. Architect will review Contractor's Submittals and will accept or take other appropriate action regarding the Submittals. Architect's review of the Submittals will be for the limited purpose of checking for general conformance with the Contract Documents and will not be conducted for the purpose of determining the accuracy and completeness of details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of Contractor. Architect's review of Submittals will not relieve Contractor of its obligations under the Contract Documents. Architect's review of Submittals will not constitute acceptance of safety precautions or construction
means, methods, techniques, sequences or procedures. Architect's acceptance of a specific item will not indicate acceptance of an assembly of which the item is a component.

G. Architect has authority to order Construction Change Directives and Field Changes in accordance with Section 7.

H. Architect will conduct inspections to determine the dates of Substantial Completion and final completion, will receive and review written guarantees and related documents required by the Contract and assembled by Contractor, and will review and certify or reject Contractor's final payment request.

I. Architect will be the interpreter of the performance and requirements of the Contract Documents. Architect's interpretations will be in writing or in the form of drawings.

J. Architect's decisions in matters relating to aesthetic effect will be final if consistent with the Contract Documents and approved by Owner.

SECTION 5 - SUBCONTRACTORS

5.1 AWARD OF SUBCONTRACTS FOR PORTIONS OF THE WORK

A. Contractor will enter into contracts with Subcontractors to perform all portions of the Work that Contractor does not customarily perform with its own employees.

B. Contractor will not contract with any Subcontractor who has been rejected by Owner. Contractor will not be required to contract with any Subcontractor against whom it has a reasonable objection.

C. If Owner rejects any Subcontractor proposed by Contractor, Contractor will propose an acceptable substitute to whom Owner has no reasonable objection.

D. Contractor will not make any substitution for any Subcontractor that has been accepted by Owner and Architect without the prior written approval of Owner and Architect.

5.2 SUBCONTRACTUAL RELATIONS

A. Contractor's responsibility for the Work includes the labor and materials of all Subcontractors, including those recommended or approved by Owner. Contractor will be responsible to Owner for proper completion and guarantee of all workmanship and materials under any subcontracts. Any warranties required for such work will be obtained by Contractor in favor of Owner and delivered to Architect. It is expressly understood and agreed that there is no contractual relationship between Owner and any Subcontractor, and under no circumstances will Owner be responsible for the non-performance or financial failure of any Subcontractor or any effects therefrom.

B. Contractor agrees to pay the Subcontractors promptly upon receipt of payment from Owner for that portion of the funds received which represents the Subcontractor's portion of the Work completed to Contractor's satisfaction for which Owner has made payment.

C. Contractor will require each Subcontractor to:
   1. Be licensed by the state in which the Project is located where such licensing is required by the governing authority;
   2. Be bound by the terms of the Contract Documents as far as they are applicable to the Subcontractor's work;
   3. Assume toward Contractor the same obligations Contractor has assumed toward Owner, including the prompt payment of its Subcontractors;
   4. Submit its applications for payment to Contractor in time to permit Contractor to make timely application to Owner;
   5. Execute claim or lien releases or lien waivers for payments made by Contractor; and
   6. Make all claims for Changes in the Work to Contractor in the same manner as Contractor is required to make such claims to Owner.

SECTION 6 - CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.1 OWNER'S RIGHT TO PERFORM WORK OR AWARD SEPARATE CONTRACTS

A. Owner reserves the right to perform work itself or to award separate contracts in connection with the Project.

B. When separate contracts are awarded, "Contractor" in the Contract Documents in each case will mean the contractor who signs each separate contract.

6.2 MUTUAL RESPONSIBILITY

A. Contractor will afford other contractors reasonable opportunity to place and store their materials and equipment on site and to perform their work and will properly connect and coordinate its Work with theirs where applicable.

B. If any part of Contractor's Work depends upon the work of any separate contractor for proper performance or results, Contractor will inspect and promptly report to Architect any apparent discrepancies or defects in such work that render it unsuitable for
proper performance and results. Failure of Contractor to so inspect and report will constitute an acceptance of the work of the separate contractor as fit and proper to receive Contractor's Work, except as to defects not then reasonably discoverable.

C. Contractor will promptly remedy damage caused by Contractor or any Subcontractor to the completed or partially completed work of other contractors or to the property of Owner or other contractors.

6.3 OWNER'S RIGHT TO CLEAN UP

If a dispute arises among Contractor and separate contractors as to the responsibility under their separate contracts for maintaining the Project free from waste materials and rubbish, Owner may clean the Project, allocate the cost among those responsible as Owner and Architect determine to be just, and withhold such cost from any amounts due or to become due to Contractor.

SECTION 7 - CHANGES IN THE WORK

7.1 CHANGES IN THE WORK RESULTING FROM AN INSTRUCTION BY OWNER OR ARCHITECT TO CONTRACTOR

A. If Owner or Architect gives Contractor an instruction that modifies the requirements of the Contract Documents or delays Substantial Completion, Contractor may be entitled to an adjustment in the Contract Sum and/or the Contract Time. If compliance with the instruction affects the cost to Contractor to perform the Work, the Contract Sum will be adjusted to reflect the reasonable increase or decrease in cost subject to the conditions set forth in Section 7.1, Paragraphs B through G. If compliance with the instruction delays Substantial Completion, the Contract Time will be extended for a period of time commensurate with such delay subject to the conditions set forth in Section 7.1, Paragraphs B through G and Section 7.3, Paragraph A and Contractor will be paid liquidated damages for the delay as set forth in Section 7.3, Paragraph B.

B. If Contractor receives an instruction from Owner or Architect that Contractor considers to be a Change in the Work, Contractor, before complying with the instruction, will notify Architect in writing that Contractor considers such instruction to constitute a Change in the Work. If Architect agrees that compliance with the instruction will constitute a Change in the Work, Contractor will furnish a proposal for a Modification in accordance with Section 7.1, Paragraphs C. and D. within ten (10) days.

C. If Contractor claims that it is entitled to an adjustment in the Contract Sum (including without limitation costs related to a time extension) as a result of an instruction by Owner or Architect, Contractor will furnish a proposal for a Change Order containing a price breakdown itemized as required by Owner. The breakdown will be in sufficient detail to allow Owner to determine any increase or decrease in Direct Costs as a result of compliance with the instruction. Any amount claimed for subcontracts will be supported by a similar price breakdown and will itemize the Subcontractor's profit and overhead charges. Profit and overhead will be subject to the following limitations:

1. The Subcontractor's profit and overhead will not exceed ten (10) percent of its Direct Costs on work performed.
2. Contractor's profit and overhead on work performed by its own crews will not exceed ten (10) percent of its Direct Costs.
3. Contractor's profit and overhead mark up on work performed by its Subcontractors will not exceed five (5) percent of the Subcontractors' charges for such work.
4. Amounts due Owner as a result of a credit change will be the actual net savings to Contractor from the Change in the Work as confirmed by Architect. On credit changes, profit and overhead on the originally estimated work will not be credited back to Owner. If both additions and credits are involved in a single Change in the Work, overhead and profit will be figured on the basis of net increase, if any, related to that Change in the Work.

D. If Contractor claims that it is entitled to an adjustment in the Contract Time as a result of an instruction from Owner or Architect, Contractor will include in its proposal justification to support Contractor's claim that compliance with the instruction will delay Substantial Completion.

E. Upon receipt of Contractor's proposal for Modification, Architect and Owner will determine whether to proceed with the Change in the Work. If Architect and Owner determine to proceed with the Change in the Work, they will issue a Change Order, a Construction Change Directive or a Field Change as appropriate.

F. Contractor agrees that if it complies with an instruction from Owner or Architect without first giving written notice to Architect as provided in Section 7.1., Paragraph B, and receiving a Change Order, Construction Change Directive or Field Change, Contractor will not be entitled to any adjustment in the Contract Sum or the Contract Time as a result of the instruction and waives any claim thereof.

G. If Contractor is instructed to perform work which it claims constitutes a Change in the Work but which Owner and Architect do not agree constitutes a Change in the Work, Contractor will comply with the instruction. Contractor may submit its claim for adjustment to the Contract Sum, the Contract Time, or both as a dispute pursuant to Section 13 within thirty (30) days after compliance with the instruction. Contractor agrees that if it fails to submit its claim for resolution pursuant to Section 13 within thirty (30) days after compliance with the instruction, then Contractor will not be entitled to any adjustment in the Contract Sum or the Contract Time as a result of the instruction and waives any claim thereof.

H. Contractor agrees that it is responsible for submitting accurate cost and pricing data to support its Change Order Proposals. Owner will have the right to examine the Contractor's records to verify the accuracy and appropriateness of the pricing data used to price change order proposals.

7.2 CHANGE IN THE WORK RESULTING FROM AN EVENT OR CIRCUMSTANCE
7.3 EXTENSIONS OF TIME

A. If an event or circumstance other than an instruction from Owner or Architect affects the cost to Contractor of performing the Work or delays Substantial Completion, Contractor may be entitled to an adjustment in the Contract Sum and/or the Contract Time. If the circumstance or event affects the cost to Contractor to perform the Work and is caused by a willful or negligent act or omission of Owner or Architect, the Contract Sum will be adjusted to reflect the reasonable increase or decrease in Contractor’s cost to perform the Work resulting from the event or circumstance, subject to the conditions set forth in Section 7.2, Paragraphs B through F. If the event or circumstance delays Substantial Completion and is described in Section 7.3, Paragraph A, the Contract Time will be extended for a period of time commensurate with such delay subject to the conditions set forth in such section. If the circumstance or event delays Substantial Completion and is caused by a willful or negligent act or omission of Owner or Architect, then Contractor will be compensated for costs incident to the delay in accordance with Section 7.3, Paragraph B. Contractor will not be entitled to any adjustment to the Contract Sum or other damages from Owner as a result of any event or circumstance unless the event or circumstance results from a willful or negligent act or omission of Owner or Architect.

B. If a Change in the Work results from any event or circumstance caused by the willful or negligent act or omission of Owner or Architect, Contractor will give Owner Written Notice of such event or circumstance within twenty-four (24) hours after commencement of the event or circumstance so that Owner can take such action as is necessary to mitigate the effect of the event or circumstance. Contractor will not be entitled to any adjustment in either the Contract Time or the Contract Sum based on any damages or delays resulting from such event or circumstance during a period more than twenty-four (24) hours prior to Contractor giving such Written Notice to Owner.

C. Contractor will submit in writing any claims for an adjustment in the Contract Time and/or the Contract Sum resulting from an event or circumstance within the time limits set forth below. In the event that Contractor fails to submit its claim in writing within the time limits set forth below, then Contractor agrees it will not be entitled to any adjustment in the Contract Time or the Contract Sum or to any other damages from Owner due to the circumstance or event and waives any claim therefor.
   1. Claims for an adjustment in the Contract Time due to Adverse Weather will be made by the tenth (10th) of the month following the month in which the delay occurred.
   2. Claims for an adjustment in the Contract Time and/or the Contract Sum due to any other circumstance or event will be submitted within seven (7) days after the occurrence of the circumstance or event.

D. If Contractor claims that it is entitled to an adjustment in the Contract Sum (including without limitation costs related to a time extension) because of an event or circumstance resulting from the willful or negligent act or omission of Owner or Architect, Contractor will furnish a proposal for a Change Order containing a price breakdown as described in Section 7.1, Paragraph C. Any amount claimed for increased labor costs as a result of the event or circumstance must be supported by a certified payroll. Any claim for rented equipment or additional material costs must be supported by invoices.

E. If Contractor claims that it is entitled to an adjustment in the Contract Time as a result of an event or circumstance, Contractor will include with its claim copies of daily logs, letters, shipping orders, delivery tickets, Project schedules, and other supporting information necessary to justify Contractor’s claim that the event or circumstance delayed Substantial Completion. If Contractor is entitled to an adjustment in the Contract Time as a result of an event or circumstance caused by the willful or negligent act or omission of Owner or Architect, Contractor will be compensated for all costs related to the delay in accordance with Section 7.3, Paragraph B.

F. Within thirty (30) days after receipt of Contractor’s claim, Architect will either deny the claim or recommend approval to Owner. If Owner approves the claim, the adjustment in the Contract Time and/or Contract Sum will be reflected in a Change Order pursuant to Section 7.5 or a Construction Change Directive pursuant to Section 7.6. If Owner or Architect denies Contractor’s claim, Contractor may submit its claim as a dispute pursuant to Section 13 within thirty (30) days of receipt of the denial of the claim. If Contractor fails to submit its claim for resolution pursuant to Section 13 within the thirty (30) day time period, then Contractor agrees it is not entitled to any adjustment in the Contract Time and/or Contract Sum or any other damages as a result of the event or circumstance and waives any claim therefor.

7.3 EXTENSIONS OF TIME

A. If Substantial Completion of the Project is delayed because of any of the following causes, then the Contract Time will be extended by Change Order for a period of time equal to such delay:
   1. Labor strikes or lock-outs;
   2. Adverse weather;
   3. Unusual delay in transportation;
   4. Unforeseen governmental requests or requirements;
   5. A Change in the Work resulting from an instruction by Owner or Architect to Contractor subject to the conditions set forth in any section. If the circumstance or event delays Substantial Completion and is caused by a willful or negligent act or omission of Owner or Architect, then Contractor will be compensated for costs incident to the delay in accordance with Section 7.3, Paragraph B.
   6. Any other event or circumstance caused by the willful or negligent act or omission of Owner or Architect.

B. Contractor will not be entitled to any compensation for delay described in Section 7.3, Paragraph A, subparagraphs 1, 2, 3 and 4. For each day of delay in Substantial Completion described in Section 7.3, Paragraph A, subparagraphs 5 and 6, Contractor will be paid liquidated damages in the amount per day set forth in the Supplementary Conditions to compensate Contractor for all damages resulting from any delay including but not limited to damages for general conditions costs, additional job site costs, additional home office overhead costs, disruption costs, acceleration costs, increase in labor costs, increase in subcontract costs, increase in materials costs, and any other costs incident to the delay. Contractor will be entitled to no other compensation relating to the delay.
C. In no event will any time extension or cost adjustment be given on account of delay which reasonably should have been anticipated by the Contractor or in circumstances where performance of the Work is, was, or would have been, delayed by any other cause for which the Contractor is not entitled to an extension.

7.4 DOCUMENTATION OF CHANGES IN THE WORK

Every Change in the Work will be documented by a Change Order, a Construction Change Directive or a Field Change. If Owner, Architect and Contractor reach agreement regarding the adjustment in the Contract Sum, if any, and the adjustment in the Contract Time, if any, resulting from a Change in the Work, then the parties will execute a Change Order pursuant to Section 7.5. If Owner, Architect and Contractor cannot reach agreement regarding the adjustment in Contract Sum or the adjustment in Contract Time resulting from a Change in the Work, then Owner and Architect will issue a Construction Change Directive pursuant to Section 7.6. Field Changes require the agreement of Architect and Contractor only.

7.5 CHANGE ORDERS

Contractor's signature upon a Change Order is Contractor's acknowledgment that it is not entitled to any additional adjustment in the Contract Sum or the Contract Time or any other damages or compensation as a result of the Change in the Work other than that provided for in the Change Order, irrespective of whether a subsequent claim for additional compensation or time extensions relating to the Change in the Work is described as a change in the requirements of the Contract Documents, a delay, a disruption of the Work, an acceleration of the Work, an impact on the efficiency of performance of the Work, an equitable adjustment, or other claim and irrespective of whether the impact of the Change in the Work is considered singly or in conjunction with the impact of other Changes in the Work.

7.6 CONSTRUCTION CHANGE DIRECTIVES

A. Contractor will promptly comply with all Construction Change Directives.

B. Pending final resolution of any adjustment in the Contract Sum or Contract Time relating to a Construction Change Directive, the amounts proposed by Owner in the Construction Change Directive may be included in Contractor's payment requests once the work relating thereto is completed.

C. If after the work described in the Construction Change Directive is completed, Owner, Architect, and Contractor reach agreement on adjustments in the Contract Sum, Contract Time, or both, such agreement will be reflected in an appropriate Change Order.

D. If the parties do not reach agreement regarding an adjustment to the Contract Sum, Contract Time, or both relating to the Construction Change Directive within thirty (30) days of the completion of the work described therein, then Contractor may submit its claim for an adjustment pursuant to Section 13 within thirty (30) days of the completion of such work. Contractor agrees that if it fails to submit its claim for resolution pursuant to Section 13 within thirty (30) days of completion of the work described in the Construction Change Directive, then it will not be entitled to an adjustment in Contract Sum or Contract Time resulting from such work except as set forth in the Construction Change Directive and waives any claim therefor.

7.7 FIELD CHANGES

Architect and Contractor will sign a Field Change order listing the Change In The Work and the Contract Sum including markups before Contractor proceeds with the Field Change.

7.8 WAIVER OF CLAIMS

Except as set forth in Section 7, Contractor will not be entitled to any adjustment in the Contract Sum or the Contract Time or for any damages of any kind whatsoever resulting from an instruction from Owner or Architect, any event or circumstance, or any act or omission of Owner or Architect and Contractor expressly waives any and all claims therefor.

SECTION 8 - TIME

8.1 TIME IS OF THE ESSENCE

All time limits stated in the Contract Documents are of the essence. By executing the Agreement, Contractor confirms that the Contract Time is a reasonable period for performing the Work. Contractor will proceed expeditiously with adequate resources and will achieve Substantial Completion within the Contract Time.

8.2 COMMENCEMENT OF THE WORK

Contractor will not commence work on the Project site until the date set forth in the Written Notice to proceed. However, Contractor may enter into subcontracts and secure material for the Project after receipt of the Agreement with Owner's authorized signature. Owner will issue the Written Notice to proceed within forty-five (45) days after Owner receives acceptable bonds and evidence of insurance pursuant to Section 11 unless Owner earlier terminates the Agreement pursuant to Section 14.

8.3 DELAY IN COMPLETION OF THE WORK

A. For each day after the expiration of the Contract Time that Contractor has not achieved Substantial Completion, Contractor will pay Owner the amount set forth in the Supplementary Conditions as liquidated damages for Owner's loss of use of the Project
and the added administrative expense to Owner to administer the Project during the period of delay. In addition, Contractor will reimburse Owner for any additional Architect's fees, attorney fees, expert fees, consultant fees, copy costs, and other expenses incurred by Owner as a result of the delay. Owner may deduct any liquidated damages or reimbursable expenses from any money due or to become due to Contractor. If the amount of liquidated damages and reimbursable expenses exceeds any amounts due to Contractor, Contractor will pay the difference to Owner within ten (10) days after receipt of a written request from Owner for payment.

B. At the time Architect certifies that Contractor has achieved Substantial Completion, Architect will identify the remaining items to be completed for final completion of the Work and will establish with Contractor a reasonable time for completion of those items. Architect will set forth the items to be completed and the time established for their completion in a Certificate of Substantial Completion. For each day that Contractor exceeds the time allowed for completion of the items set forth in the Certificate of Substantial Completion, Contractor will pay to Owner as liquidated damages for additional administrative expenses the amount set forth in the Supplementary Conditions. In addition, Contractor will reimburse Owner for any additional Architect's fees, attorney fees, expert fees, consultant fees, copy costs, and other expenses incurred by Owner as a result of the delay in completing such items.

SECTION 9 - PAYMENTS AND COMPLETION

9.1 SCHEDULE OF VALUES

Contractor will submit to Architect a schedule of values which allocates the Contract Sum to various portions of the Work. The schedule of values will be supported by such data to substantiate its accuracy as required by Architect. This schedule, when accepted by Owner and Architect, will be used as a basis for reviewing Contractor's payment requests.

9.2 PAYMENT REQUESTS

A. Not more than once a month, Contractor will submit a payment request to Architect for Work completed, materials stored on the site, and for materials stored offsite as of the date of the payment request. The amount of the payment request will be based upon the schedule of values and will be equal to the value of the Work completed:
   1. Less retention;
   2. Less all prior amounts paid by Owner to Contractor as part of the Contract Sum; and
   3. Less allowable offsets.

The payment request may include Changes in the Work that have been performed by Contractor and authorized by Owner and/or Architect pursuant to Section 7. If a payment request includes materials stored offsite, Contractor will include with the payment request a list of the materials, the location where they are stored and the written request of Contractor and its performance bond surety that payment be made for such materials.

B. Contractor warrants and guarantees that upon the receipt of payment for materials and equipment, whether incorporated in the Project or not, title to such materials and equipment will pass to Owner free and clear of all liens, claims, security interests, or encumbrances. Notwithstanding this payment and passage of title, Contractor will remain responsible for all such materials and equipment until actual delivery to the project site, incorporation into the Work, and final acceptance by Owner. Contractor further warrants that no material or equipment covered by a payment request is subject to an agreement under which an interest therein or an encumbrance thereon is retained by the seller or any other person or entity.

9.3 PAYMENT REQUEST CERTIFICATION

A. Architect will, within seven (7) days after receipt of Contractor's payment request, forward to Owner the payment request certified for such amount as Architect determines is properly due. If Architect certifies less than the full amount of the payment request, Architect will notify Contractor and Owner of Architect's reasons for withholding certification of the full amount requested.

B. The certification of the payment request will constitute a representation by Architect to Owner based upon Architect's observations at the site and the data comprising the payment request, that the Work has progressed to the point indicated and that, to the best of Architect's knowledge, information, and belief, the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to minor deviations from the Contract Documents correctable prior to completion, and to specific qualifications expressed by Architect. However, the certification of the payment request will not constitute a representation that Architect has:
   1. Conducted exhaustive or continuous on-site inspections to check the quantity or quality of the Work;
   2. Reviewed construction means, methods, techniques, sequences, or procedures;
   3. Reviewed copies of requisitions received from Subcontractors or other data requested by Owner to substantiate Contractor's right to payment; or
   4. Made examination to ascertain how or for what purpose Contractor has used money previously paid on account of the Contract Sum.

C. In taking action on Contractor's payment request, Owner will be entitled to rely on the accuracy and completeness of the information furnished by Contractor.

9.4 DECISIONS TO WITHHOLD CERTIFICATION AND PAYMENT

A. Architect may withhold certification of a payment request in whole or in part to the extent reasonably necessary to protect Owner if, in the opinion of Architect, the representations to Owner required by Section 9.3, Paragraph B cannot be accurately made. If
Architect is unable to certify payment in the amount of the payment request, Architect will notify Contractor and Owner as provided in Section 9.3, Paragraph A. If Contractor and Architect cannot agree on a revised amount, Architect will promptly certify a payment request for the amount for which Architect is able to make such representations to Owner. Architect may also decide not to certify payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or a part of a payment request previously certified, to such extent as may be necessary in Architect's opinion to protect Owner from loss because of:
1. Defective work not remedied;
2. Third-party claims filed or reasonable evidence indicating probable filing of such claims;
3. Failure of Contractor to make payments properly to Subcontractors for labor, materials, equipment, construction or services;
4. Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
5. Damage to Owner or another contractor for which Contractor is responsible;
6. Reasonable evidence that the Work will not be completed within the Contract Time and that the unpaid balance will not be adequate to cover the cost of completing the Work and damages for the anticipated delay; or
7. Contractor's persistent failure to carry out the Work in accordance with the Contract Documents.

B. Owner reserves the right to withhold payments to Contractor, subsequent to Architect's certification of any payment request, in order to protect Owner from loss due to any condition described in Section 9.4, Paragraph A, Subparagraphs 1 through 7. Upon satisfactory resolution of any such conditions, payments so withheld will be made.

9.5 PROGRESS PAYMENTS
A. Owner will pay Contractor progress payments within the parameters of Section 9.2 within fifteen (15) days after Owner receives the certified payment request from Architect.
B. Owner will make payments to Contractor by either placing the payments in the mail addressed to Contractor or by electronic transfer at Owner's discretion.
C. Upon receipt of any payment from Owner, Contractor will pay to each Subcontractor the amount paid to Contractor on account of such Subcontractor's portion of the Work.
D. Contractor will maintain a copy of each payment request at the Project site for review by the Subcontractors.
E. No payment made under the Contract Documents, either in whole or in part, will be construed to be an acceptance of defective or improper materials or workmanship.
F. In addition and notwithstanding the foregoing, Owner will also withhold and retain 10% of payments made to Contractor.
G. Owner will pay any unpaid retention less any amounts withheld pursuant to Section 9.4 within forty-five (45) days after Contractor achieves Substantial Completion, submits its payment request for retained funds, delivers to the Architect Owner's form entitled "Contractor's Substantial Completion Affidavit and Consent of Surety" fully executed by Contractor and its surety, obtains Waiver and Release documents executed by all subcontractors and suppliers having claim against the retained funds, and Owner receives a certificate of occupancy.

9.6 FINAL PAYMENT
A. Owner will make full and final payment of the Contract Sum within thirty (30) days of the completion of all of the following requirements:
1. Contractor has submitted its final payment request;
2. Architect has declared to Owner in writing that the Work is complete;
3. Contractor has obtained waiver and release upon final payment documents executed by all of the subcontractors performing work and/or providing materials covered by the Contractor's final payment request; and
4. Contractor has collected and provided to Owner all manufacturers’ and other guaranties and warranties, properly signed and endorsed to Owner, that are required by the Contract Documents that extend for a period beyond one year after substantial completion. (Delivery of such guaranties and warranties will not relieve Contractor for any obligation assumed under any other provision of the Contract Documents.)
B. Acceptance of final payment by Contractor or any Subcontractor will constitute a waiver of claims by the payee except for those claims previously made in writing pursuant to Section 7 and identified by Contractor in its affidavit as still pending.
C. If the aggregate of previous payments made by Owner exceeds the amount due Contractor, Contractor will reimburse the difference to Owner.

SECTION 10 - PROTECTION OF PERSONS AND PROPERTY
10.1 SAFETY PRECAUTIONS AND PROGRAMS
Contractor will be responsible to Owner for initiating and supervising all safety programs in connection with the performance of the Work.

10.2 SAFETY OF PERSONS AND PROPERTY
A. Contractor will take reasonable precautions to prevent damage, injury, or loss to:
1. All persons on the site;
2. The Work and materials and equipment to be incorporated into the Work; and
3. Other property at the site or adjacent to it.

B. Contractor will give notices and comply with applicable laws, ordinances, rules, regulations, and other lawful requirements of public authorities bearing on the safety or protection of persons and property. No work will be performed that may pose an undue safety hazard to Contractor, Contractor’s employees, or any other person.

C. Contractor will designate a responsible member of its organization at the site whose duty will be the prevention of accidents. This person will be Contractor’s onsite representative unless otherwise designated in writing by Contractor to Owner and Architect.

10.3 EMERGENCIES

In case of an emergency endangering life or threatening the safety of any person or property, Contractor may, without waiting for specific authorization from Architect or Owner, act at its own discretion to safeguard persons or property. Contractor will immediately notify Architect of such emergency action and make a full written report to Architect within five (5) days after the event.

10.4 HAZARDOUS MATERIALS

In the event the Contractor encounters on the site material reasonably believed to be hazardous materials which have not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner and Architect in writing. The Work in the affected area shall be resumed in the absence of hazardous materials, or when it has been rendered harmless, by written agreement of the Owner and Contractor.

SECTION 11 - INSURANCE AND BONDS

11.1 CONTRACTOR’S LIABILITY INSURANCE

A. Contractor will obtain the following insurance and provide evidence thereof as described below prior to commencement of the Work or within ten (10) days after signing the Agreement, whichever is earlier:

1. Workers Compensation Insurance.
2. Employers Liability Insurance with minimum limits of the greater of $500,000 E.L. each accident, $500,000 E. L. disease-each employee, $500,000 E.L. disease-policy limit or as required by the law of the state in which the Project is located.
3. Commercial General Liability Insurance – ISO Form CG 00 01 (12/07) or equivalent Occurrence policy which will provide primary coverage to the additional insureds (the Owner and the Architect) in the event of any Occurrence, Claim, or Suit with:
   a. Limits of the greater of Contractor’s actual coverage amounts or the following:
      1) $2,000,000 General Aggregate;
      2) $2,000,000 Products - Comp/Ops Aggregate;
      3) $1,000,000 Personal and Advertising Liability;
      4) $1,000,000 Each Occurrence;
      5) $50,000 Fire Damage to Rented Premises (Each Occurrence).
   b. Endorsements attached to the General Liability policy including the following or their equivalent:
      1) ISO Form CG 25 03 (05/09), Amendment of Limits of Insurance (Designated Project or Premises), describing the Agreement and specifying limits as shown above.
      2) ISO Form CG 20 10 (07/04), Additional Insured -- Owners, Lessees, Or Contractors (Form B), naming Owner and Architect as additional insureds.
4. Automobile Liability Insurance, with:
   a. Combined Single Limit each accident in the amount of $1,000,000 or Contractor’s actual coverage, whichever is greater; and
   b. Coverage applying to "Any Auto."

B. Contractor will provide evidence of such insurance to Owner as follows:

1. Deliver to Owner a Certificate of Liability Insurance, on ACORD 25 (2010/06) Form, or equivalent:
   a. Listing Owner and its consultants as the Certificate Holders and Additional Insured on the general liability and any excess liability policies;
   b. Attaching the ISO or equivalent endorsements set forth above to the Certificate of Liability Insurance;
   c. Identifying the Project;
   d. Listing the insurance companies providing coverage (All companies listed must be rated in A.M. Best Company Key Rating Guide-Property-Casualty and each company must have a rating of B+ Class VII or better. Companies which are not rated are not acceptable); and
   e. Bearing the name, address and telephone number of the producer and signed by an authorized representative of the producer. The signature may be original, stamped, or electronic.

C. Contractor will maintain, from commencement of the Work, Insurance coverage required herein as follows:

1. Commercial General Liability Insurance through expiration of warranty period specified in Section 12.2, Paragraph B. including completion of any warranty repairs; and
2. All other insurance through Final Payment.

D. Owner reserves the right to reject any insurance company, policy, endorsement, or certificate of insurance with or without cause.
E. Owner may, in writing and at its sole discretion, modify the insurance requirements.

F. The cost of insurance as required above will be the obligation of Contractor. Contractor will be responsible for payment of all deductible amounts under all insurance.

G. Owner will provide builders risk insurance for the cost of the Project. The policy will be written on an all risk basis with coverage for perils of wind, flood, earthquake, and terrorism, with exclusions standard for the insurance industry. The policy will be subject to a $5,000 deductible per occurrence which will be the responsibility of Contractor and will not be a reimbursable expense. Owner will provide a copy of the terms and conditions of the builders risk policy to Contractor upon Contractor’s request. Contractor will comply with terms, conditions, and deadlines of the builders risk policy. The terms, conditions, and deadlines of the builders risk policy shall govern coverage. In addition, when there is a loss which may be covered by the builders risk insurance policy, Contractor will comply with the following:
   1. Contractor will report the loss immediately to builders risk commercial insurer by calling 1-866-537-7475 and shall make such further written submissions as required and otherwise comply with all requirements of the builders risk policy.
   2. Contractor will report the loss immediately to the Owner.
   3. Contractor will immediately notify its general liability insurance carrier of the loss.
   4. Contractor will take all necessary and appropriate actions to protect the property and individuals from further loss, harm, and injury. In the event there are damages resulting from fire or water, restoration shall be performed only by a certified restoration contractor.
   5. To the extent possible, Contractor will preserve and not disturb the evidence of the loss until after the builders risk commercial insurer and all interested parties and their insurance carriers have had the opportunity to view and investigate the site and loss.
   6. Contractor will cooperate with Owner and the builders risk commercial insurer in the investigation, documentation, and settlement of loss claims, including without limitation promptly responding to all requests for information and documentation from the builders risk commercial insurer and/or Owner.

11.2 PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

A. Prior to commencement of the Work or within ten (10) days after signing the Agreement, whichever is earlier, Contractor will furnish to Owner a performance bond and a labor and material payment bond each in an amount equal to one hundred percent (100%) of the Contract Sum as security for all obligations arising under the Contract Documents. Such bonds will:
   2. Be issued by a surety company or companies licensed in the state in which the Project is located and holding valid certificates of authority under Sections 9304 to 9308, Title 31, of the United States Code as acceptable sureties or reinsurance companies on federal bonds.
   3. Have a penal sum obligation not exceeding the authorization shown in the current revision of Circular #570 as issued by the United States Treasury Department, i.e. “Treasury List”.
   4. Be accompanied by a certified copy of the power of attorney stating the authority of the attorney-in-fact executing the bonds on behalf of the surety.

B. Owner reserves the right to reject any surety company, performance bond, or labor and material payment bond with or without cause.

C. The cost of the bonds as required above will be the obligation of Contractor.

SECTION 12 - UNCOVERING AND CORRECTION OF WORK

12.1 UNCOVERING OF WORK

Contractor will notify Architect at least twenty-four (24) hours in advance of performing work that would cover up work or otherwise make it difficult to perform inspections required by the Specifications or by applicable governing authorities. Should any such work be covered without proper notification having been given to Architect, Contractor will uncover that work for inspection at its own expense.

12.2 CORRECTION OF WORK

A. Contractor will promptly correct any portion of the Work that is rejected by Architect or which fails to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed, or completed. Contractor will bear the cost of correcting such rejected Work, including additional testing and inspection costs, compensation for Architect's services, and any other expenses made necessary thereby.

B. Contractor will remedy any defects due to faulty materials, equipment, or workmanship which appear within a period of one (1) year from the date of Substantial Completion or within such longer period of time as may be prescribed by law or by the terms of any applicable special warranty required by the Contract Documents. Contractor will pay all costs of correcting faulty work, including without limitation additional Architect's fees, attorney fees, expert fees, consultant fees, copy costs, and other expenses when incurred.

C. Nothing in the Contract Documents will be construed to establish a period of limitation within which Owner may enforce the obligation of Contractor to comply with the Contract Documents. The one-year period specified above has no relationship to the time within which compliance with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish Contractor's liability with respect to Contractor's obligations.
12.3 ACCEPTANCE OF NONCONFORMING WORK

A. If Owner prefers to accept any portion of the Work not in conformance with the Contract Documents, Owner may do so instead of requiring removal and correction of the nonconforming Work. In that event, the Contract Sum will be reduced by an amount agreed upon by the parties that reflects the difference in value to Owner between the Work as specified and the nonconforming Work. Such adjustment may consider increased maintenance costs, early replacement costs, increased inefficiency of use, and the like and will be effective whether or not final payment has been made. Such adjustment will be reflected in a Change Order pursuant to Section 7.5.

B. Temporary or trial usage by Owner or Architect of mechanical devices, machinery, apparatus, equipment, or other work or materials supplied under the Contract Documents prior to written acceptance by Architect, will not constitute Owner's acceptance.

SECTION 13 - RESOLUTION OF DISPUTES

13.1 SUBMITTAL OF DISPUTE

In the event there is any dispute arising under this Agreement which cannot be resolved by agreement between the parties, either party may submit the dispute with all documentation upon which it reifies to the Director of Architecture, Engineering, and Construction, Meetinghouse Facilities Department, 50 East North Temple, Salt Lake City, Utah 84150, who will convene a dispute resolution conference within thirty (30) days. The dispute resolution conference will constitute settlement negotiations and any settlement proposal made pursuant to the conference will not be admissible as evidence of liability. In the event that the parties do not resolve their dispute pursuant to the dispute resolution conference, either party may commence legal action to resolve the dispute. Any such action must be commenced within six (6) months from the first day of the dispute resolution conference or be time barred. Submission of the dispute to the Director as outlined above is a condition precedent to the right to commence legal action to resolve any dispute. In the event that either party commences legal action to adjudicate any dispute without first submitting the dispute to the Director, the other party will be entitled to obtain an order dismissing the litigation without prejudice and awarding such other party any costs and attorney fees incurred by that party in obtaining the dismissal, including without limitation copy costs, and expert and consultant fees and expenses.

13.2 CONTRACTOR TO PROCEED WITH DILIGENCE

Pending final resolution of a dispute hereunder, Contractor will proceed diligently with the performance of its obligations under this Agreement.

SECTION 14 - TERMINATION

14.1 TERMINATION BY CONTRACTOR

In the event Owner materially breaches any term of the Contract Documents, Contractor will promptly give Written Notice of the breach to Owner. If Owner fails to cure the breach within ten (10) days of the Written Notice, Contractor may terminate the Agreement by giving Written Notice to Owner and recover from Owner the percentage of the Contract Sum represented by the Work completed on the Project site as of the date of termination, less any offsets. Contractor will not be entitled to unearned profits or any other compensation or damages as a result of the termination and hereby waives any claim therefor. Contractor will provide to Owner all warranty, as built, inspection, and other close out documents as well as materials that Contractor has in its possession or control at the time of termination. Without limitation, Contractor's indemnities and obligations under section 3.14 as well as all warranties in the specifications relative to Work provided through the date of termination survive a termination hereunder.

14.2 TERMINATION BY OWNER FOR CAUSE

Should Contractor fail to provide Owner with the bonds and certificates of insurance required by Section 11 within the time specified therein, make a general assignment for the benefit of its creditors, fail to apply enough properly skilled workmen or specified materials to properly prosecute the Work in accordance with Contractor’s schedule, or otherwise materially breach any provision of the Contract Documents, then Owner may, without any prejudice to any other right or remedy, give Contractor Written Notice thereof. If Contractor fails to cure its default within ten (10) days, Owner may terminate the Agreement by giving Written Notice to Contractor. In such case, Contractor may, in Owner’s sole discretion, take legal assignment of subcontracts and other contractual rights of Contractor and/or take possession of the premises and all materials, tools, equipment, and appliances thereon, and finish the Work by whatever method Owner deems expedient. Contractor will not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Sum exceeds the expense of finishing the Work, including compensation for additional administrative, architectural, consultant, and legal services (including without limitation attorney fees, expert fees, copy costs, and other expenses), such excess will be paid to Contractor. If such expense exceeds the unpaid balance, Contractor will pay the difference to Owner. Contractor will provide to Owner all warranty, as built, inspection, and other close out documents as well as materials that Contractor has in its possession or control at the time of termination. Without limitation, Contractor's indemnities and obligations under section 3.14 as well as all warranties in the specifications relative to Work provided through the date of termination survive a termination hereunder.

14.3 TERMINATION BY OWNER FOR CONVENIENCE

Notwithstanding any other provision contained in the Contract Documents, Owner may, without cause and in its absolute discretion, terminate the Agreement at any time. In the event of such termination, Contractor will be entitled to recover from Owner the
percentage of the Contract Sum equal to the percentage of the Work which Architect determines has been completed on the Project site as of the date of termination together with any out of pocket loss Contractor has sustained with respect to materials and equipment as a result of the termination prior to completion of the Work, less any offsets. Contractor will not be entitled to unearned profits or any other compensation as a result of the termination and hereby waives any claim therefor. Contractor will provide to Owner all warranty, as built, inspection, and other close out documents as well as materials that Contractor has in its possession or control at the time of termination. Owner may, in Owner’s sole discretion, take legal assignment of subcontracts and other contractual rights of Contractor. Without limitation, Contractor’s indemnities and obligations under section 3.14 as well as all warranties in the specifications relative to Work provided through the date of termination survive a termination hereunder.

SECTION 15  -  MISCELLANEOUS PROVISIONS

15.1 GOVERNING LAW

The parties acknowledge that the Contract Documents have substantial connections to the State of Utah. The Contract Documents will be deemed to have been made, executed, and delivered in Salt Lake City, Utah. To the maximum extent permitted by law, (i) the Contract Documents and all matters related to their creation and performance will be governed by and enforced in accordance with the laws of the State of Utah, excluding conflicts of law rules; and (ii) all disputes arising from or related to the Contract Documents will be decided only in a state or federal court located in Salt Lake City, Utah and not in any other court or state. Toward that end, the parties hereby consent to the jurisdiction of the state and federal courts located in Salt Lake City, Utah and waive any other venue to which they might be entitled by virtue of domicile, habitual residence, place of business, or otherwise.

15.2 NO WAIVER

No action or failure to act by Owner, Architect, or Contractor will constitute a waiver of a right or duty afforded them under the Contract Documents, nor will such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

15.3 RULE OF CONSTRUCTION

Owner and Contractor agree that the Contract Documents will be deemed to have been drafted by both Owner and Contractor and will not be construed against either Owner or Contractor because of authorship.

15.4 ENFORCEMENT

In the event either party commences legal action to enforce or rescind any provision of the Contract Documents, the prevailing party will be entitled to recover its attorney fees and costs, including without limitation all copy costs and expert and consultant fees and expenses, incurred in that action and on all appeals, from the other party.

15.5 TESTS AND INSPECTIONS

A. Owner and Architect have the right to have tests made when they deem it necessary. Tests conducted by Owner or Architect will be paid for by Owner. Should a test reveal a failure of the Work to meet Contract Document requirements, the cost of the test as well as subsequent tests related to the failure necessary to determine compliance with the Contract Documents will be paid for by Owner, with the cost thereof deducted from the Contract Sum by Modification.

B. Tests will be made in accordance with recognized standards by a competent, independent testing laboratory. Materials found defective or not in conformity with Contract Document requirements will be promptly replaced or repaired at the expense of Contractor.

C. Owner and Architect have the right to obtain samples of materials to be used in the Work and to test samples for determining whether they meet Contract Document requirements. Samples required for testing will be furnished by Contractor and selected as directed by Architect. Samples may be required from the sample's source, point of manufacture, point of delivery, or point of installation at Architect's discretion. Samples not required as a Submittal in the Specifications will be paid for by Owner. Should tests reveal a failure of the Sample to meet the Contract Document requirements, Contractor will provide other Samples that comply with the requirements of the Contract Documents.

END OF DOCUMENT
ITEM 1 - GENERAL

1. Conditions of the Agreement and General Conditions apply to each Division of the Specifications.
2. Provisions contained in Division 01 apply to all Divisions of the Specifications.

ITEM 2 - LIQUIDATED DAMAGE AMOUNTS:

1. The amount of liquidated damages to the benefit of the Contractor for delays under General Conditions Section 7.3, Paragraph B is $_____ per day.
2. The amount of liquidated damages to the benefit of the Owner for delays in Substantial Completion of the Work under General Conditions Section 8.3, Paragraph A is $_____ per day.
3. The amount of liquidated damages to the benefit of the Owner for delays in completing work itemized on the Substantial Completion Certificate under General Conditions Section 8.3, Paragraph B is $_____ per day.

ITEM 3 - PERMITS

1. Delete Section 3.6, Paragraph B of the General Conditions and replace with the following:

B.

ITEM 4 - MISCELLANEOUS CHANGES IN GENERAL CONDITIONS

FOR PROJECTS EXCEEDING $5 MILLION – CONTRACTOR TO PROVIDE BUILDER’S RISK INSURANCE (AND NOT OWNER)

Replace Section 11.1 Contractor’s Liability Insurance of the General Conditions with the following:

11.1 CONTRACTOR’S LIABILITY INSURANCE

A. Contractor will obtain the following insurance and provide evidence thereof as described below prior to commencement of the Work or within ten (10) days after signing the Agreement, whichever is earlier:

1. Workers Compensation Insurance.
2. Employers Liability Insurance with minimum limits of the greater of: $500,000 E.L. each accident, $500,000 E. L. disease-each employee, $500,000 E.L. disease-policy limit; or as required by the law of the state in which the Project is located.
3. Commercial General Liability Insurance – ISO Form CG 00 01 (12/07) or equivalent Occurrence policy which will provide primary coverage to the additional insureds (the Owner and the Architect) in the event of any Occurrence, Claim, or Suit with:
   a. Limits of the greater of Contractor’s actual coverage amounts or the following:
      1) $2,000,000 General Aggregate;
      2) $2,000,000 Products - Comp/Ops Aggregate;
      3) $1,000,000 Personal and Advertising Injury;
      4) $1,000,000 Each Occurrence;
      5) $50,000 Damage to Rented Premises.
   b. Endorsements attached to the General Liability policy including the following or their equivalent:
      1) ISO Form CG 25 03 (05/09), Designated Construction Project(s) General Aggregate Limit, describing the project and specifying that limits apply to each project of the contractor.
      2) ISO Form CG 20 10 (07/04), Additional Insured – Owners, Lessees or Contractors – Scheduled Person or Organization, naming Owner and Architect as additional insureds.
4. Automobile Liability Insurance, with:
a. Combined Single Limit each accident in the amount of $1,000,000 or Contractor's actual coverage, whichever is greater; and
b. Coverage applying to "Any Auto" or equivalent to all owned autos, hired autos, and non-owned autos.

5. Builder’s Risk Insurance Policy – ISO Form CP 00 20 (10/12), Builders Risk Coverage (or equivalent form) and ISO Form CP 10 30 (10/12) Causes of Loss – Special Form, and ISO Form CP 11 20 (06/07) Builders Risk – Collapse During Construction (or equivalent form) with Limits of Insurance in the amount of the Guaranteed Maximum Price.
   a. Policy will cover materials stored at temporary storage locations and materials in transit.
   b. Include Owner and Subcontractors as additional insureds.
   c. Policy will be subject to a deductible of not less than $5,000 per occurrence which will be the responsibility of Contractor and will not be included in the Cost of the Work or be a reimbursable expense.

B. Contractor will provide evidence of such insurance to Owner as follows:
   1. Deliver to Owner a Certificate of Insurance on ACORD 25 (2010/05) or equivalent:
      a. Listing Owner as the Certificate Holder and Owner and Architect as Additional Insureds on general liability and any excess liability policies;
      b. Attaching the endorsements set forth above for additional insured on general liability (CG 20 10 07/04) and Designated Construction Project Aggregate Limit (CG 25 03 05/09).
      c. Identifying the Project.
      d. Listing the insurance companies providing coverage. All companies must be rated in A.M. Best Company’s Key Rating Guide – Property-Casualty, current edition, at a rating B+ Class VII or better. Companies that are not rated are not acceptable.
      e. Bearing the name, address, and telephone number of the producer and signed by an authorized representative of the producer. The signature may be original, stamped, or electronic. A faxed or digital copy is also acceptable.
   2. Deliver to Owner a Certificate of Insurance on ACORD 27, Evidence of Property Insurance, for the Builders Risk Insurance Policy attaching the endorsement giving evidence that the Owner and all Subcontractors are listed as additional insureds on the Builders Risk Policy.

C. Contractor will maintain, from commencement of the Work, Insurance coverage required herein as follows:
   1. Commercial General Liability Insurance through expiration of warranty period specified in Section 12.2, Paragraph B. including completion of any warranty repairs;
   2. Builders’ Risk Insurance through Substantial Completion; and
   3. All other insurance through final payment.

D. In the event of a loss, or upon request by Owner, Contractor will provide Owner with a copy of required insurance policies above.

E. Owner reserves the right to reject any insurance company, policy, endorsement, or certificate of insurance with or without cause.

F. Owner may, in writing and at its sole discretion, modify the insurance requirements.

ITEM 5 - STATE SPECIFIC SUPPLEMENTARY CONDITIONS

Alabama

RETENTION APPLIED TO CONTRACTOR PAYMENTS FOR PROJECTS IN ALABAMA:

Replace section 9.5 F of the General Conditions with the following:

F. In addition and notwithstanding the forgoing, Owner may also withhold and retain 10% of payments made to Contractor until the work is 50% complete. Thereafter, Owner may continue to hold such retained amounts until completion but no additional retainage based solely on a percentage of the payments being made will be withheld from future payments.
Arizona

PAYMENTS AND COMPLETION

*Replace subsections 9.3.A of the General Conditions with the following:*

A. Architect will, within fourteen (14) Days after receipt of Contractor's payment request, either forward to Owner the payment request certified for such amount as Architect determines is properly due or, if Architect certifies less than the full amount of the payment request, notify Contractor and Owner of Architect's reasons for withholding certification of the full amount requested.

*Replace subsections 9.4.A of the General Conditions with the following:*

A. Architect may withhold certification of a payment request in whole or in part to the extent reasonably necessary to protect Owner if, in the opinion of Architect, the representations to Owner required by Section 9.3, Paragraph B cannot be accurately made. If Architect is unable to certify payment in the amount of the payment request, Architect will notify Contractor and Owner as provided in Section 9.3, Paragraph A. If Contractor and Architect cannot agree on a revised amount, Architect will promptly certify a payment request for the amount for which Architect is able to make such representations to Owner. Architect may also decide not to certify payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or a part of a payment request previously certified, to such extent as may be necessary in Architect's opinion to protect Owner from loss because of:

1. Defective Work or materials not remedied;
2. Unsatisfactory job progress;
3. Third-party claims filed or reasonable evidence indicating probable filing of such claims;
4. Failure of Contractor or Subcontractors to make timely payments for labor, materials, equipment, construction or services;
5. Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
6. Damage to Owner or another contractor for which Contractor is responsible;
7. Disputed work or materials;
8. Reasonable evidence that the Work will not be completed within the Contract Time and that the unpaid balance will not be adequate to cover the cost of completing the Work and damages for the anticipated delay; or
9. Contractor’s failure to comply with material provisions of the Contract Documents.

*Replace subsections 9.5.A of the General Conditions with the following:*

A. Owner will pay Contractor progress payments within the parameters of Sections 9.2 through 9.4 within seven (7) Days after Owner receives the certified payment request from Architect.

*Replace subsections 9.5.F and 9.5.G of the General Conditions with the following:*

F. Owner may withhold up to 150% of the direct costs and expenses the Owner reasonably expects to incur to protect the Owner from loss for which the Contractor is responsible and that results from the Contractor’s failure to complete portions of the Work at the time of substantial completion or for any reasons set forth in writing.
G. Owner may also withhold 10% retention from each payment request.

H. After Contractor achieves Substantial Completion of the Project, it shall submit to Owner a payment request for retained funds and deliver to Architect Owner's form entitled "Contractor's Substantial Completion Affidavit and Consent of Surety" fully executed by Contractor and its surety. Architect will, within fourteen (14) days of Contractor's request for release of retention, forward to Owner the release-of-retention request certified for such amount as Architect determines is properly due. If Architect certifies less than the full amount of the request-for-retention request, Architect will notify Contractor and Owner of Architect's reasons for withholding certification of the full amount requested.

I. Owner will pay any unpaid retention amounts, less any amounts withheld pursuant to Section 9.4, within seven (7) days after Owner receives the certified release-of-retention request from Architect.

Replace the entirety of subsection 9.6 of the General Conditions with the following:

A. Upon completion of the Work including all of the remaining items of Work identified in the Certificate of Substantial Completion, Contractor will:
   1. Give written notice of completion of the Work to Architect;
   2. Provide to Architect conditional or unconditional releases or waivers of lien signed by Contractor and all Subcontractors performing work and/or providing labor, materials or equipment for the Project; and
   3. Provide to Owner all manufacturer's and other warranties and guarantees required by the Contract Documents, properly signed and endorsed to Owner.

B. After Contractor submits the above-listed documents, Contractor shall provide Architect with Contractor's final payment request. Upon receipt of such payment request, Architect will promptly inspect the Work. If the Architect finds that the Work (including all remaining items of Work identified in the Certificate of Substantial Completion) has been completed in accordance with the Contract Documents, Architect will certify the final payment request within fourteen (14) days after receiving a final payment request from Contractor, either forward to Owner the final payment request certified for such amount as Architect determines is properly due or, if Architect certifies less than the full amount of the payment request, notify Contractor and Owner of Architect's reasons for withholding certification of the full amount requested.

C. Owner will make full and final payment of the Contract Sum within seven (7) Days after completion of all of the following requirements;
   1. Architect has declared to Owner in writing that the Work is complete;
   2. Architect has received from Contractor conditional or unconditional releases or waivers of lien signed by all Subcontractors performing work and/or providing labor, materials or equipment for the Project;
   3. Contractor has submitted Contractor's final payment request;
   4. Contractor has provided to Owner all manufacturer's and other warranties and guarantees required by the Contract Documents, properly signed and endorsed to Owner; and
   5. Owner receives the certified final payment request from Architect.

D. If the aggregate of previous payments made by Owner exceeds the amount due Contractor, Contractor will reimburse the difference to Owner within ten (10) Days after receipt of Written Notice from Owner requesting such payment.

E. Acceptance of final payment by Contractor or any Subcontractor will constitute a waiver of claims
by the payee except for those claims previously made in writing pursuant to Section 7 and identified by Contractor in its affidavit as still pending.

PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND FOR PROJECTS IN ARIZONA:

Add the following provisions as section 11.2(A)(5) and (6) of the General Conditions:

5. Have print size no smaller than 10 point type, have at least a one-half inch margin across the top, bottom and the left and right sides from top to bottom, and the first page will have a top margin of at least two inches.

6. Have a provision allowing the prevailing party in a suit on such bond to recover as a part of the judgment reasonable attorneys’ fees.

Add the following as section 11.2(D) of the General Conditions:

D. Contractor will record the payment bond, together with a copy of the Contract, which contract must contain a legal description of the land on which the work is to be performed, with the county recorder in the county where the Project is located.

Arkansas
N/A

California

PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND FOR PROJECTS IN CALIFORNIA:

Replace section 11.2. of the General Conditions with the following -

11.2 PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

A. Prior to commencement of the Work or within ten (10) days after signing the Agreement, whichever is earlier, Contractor will furnish to Owner a performance bond and a labor and material payment bond each in an amount equal to one hundred percent (100%) of the Contract Sum as security for all obligations arising under the Contract Documents. Such bonds will:


2. Be issued by a surety company or companies licensed in the state in which the Project is located and holding valid certificates of authority under Sections 9304 to 9308, Title 31, of the United States Code as acceptable sureties or reinsurance companies on federal bonds.

3. Have a penal sum obligation not exceeding the authorization shown in the current revision on Circular #570 as issued by the United States Treasury Department, i.e. “Treasury List”.

4. Be accompanied by a certified copy of the power of attorney stating the authority of the attorney-in-fact executing the bond on behalf of the surety.

B. The payment bond shall be conditioned for the payment in full of the claims of all claimants and shall by its terms inure to the benefit of all claimants so as to give a claimant a right of action to enforce liability on the bond.

C. Owner reserves the right to reject any surety company, performance bond, or labor and material payment bond with or without cause.

D. The cost of the bonds as required above will be the obligation of Contractor.

E. Before the commencement of Work on the Project, the Contractor shall, on behalf of the Owner, record the payment bond together with a copy of the Contract, with the county recorder in the county where the Project is located.
**Colorado**

**COLORADO STATE SALES TAX:**

*Add the following to the General Conditions:*

1. Contractor will make an application to State Department of Revenue for certificate of exemption to permit purchase of building materials for construction of this Project without payment of Sales Tax. Applications and certificates will be on forms provided by the Department of Revenue.

2. Prior to start of construction, Contractor will furnish to the Owner copies of the applications submitted and certificates obtained. Upon receipt of the certificate Contractor shall make a copy for each subcontractor involved in the Project and complete it by filling in the subcontractor’s name and address and signing it. The original certificate and copies of all certificates that the Contractor issues to subcontractors should be kept at the Contractor’s place of business for a minimum of three years.

3. The Owner’s sales tax exemption number for the State of Colorado is 98-01587.

**Connecticut**

**RETENTION APPLIED TO CONTRACTOR PAYMENTS FOR PROJECTS IN CONNECTICUT:**

*Replace section 9.5.F of the General Conditions with the following:*

- **F** In addition and notwithstanding the foregoing, Owner may also withhold and retain 5% of payments made to Contractor.

**PAYMENT OF RETAINED FUNDS IN CONNECTICUT:**

*Replace section 9.5 G of the General Conditions with the following:*

- **G** Owner will pay any unpaid retention less any amounts withheld pursuant to Section 9.4 within thirty (30) days after Contractor achieves Substantial Completion, submits its payment request for retained funds, delivers to the Architect Owner’s form entitled “Contractor’s Substantial Completion Affidavit and Consent of Surety” fully executed by Contractor and its surety, obtains Waiver and Release documents executed by all subcontractors and suppliers having claim against the retained funds, and Owner receives a certificate of occupancy.

**CONNECTICUT STATE SALES TAX:**

*Add the following to the General Conditions:*

- **1** Sales of materials and supplies that will be physically and permanently incorporated into the construction project should be exempt from Connecticut state sales tax. The Owner’s sales tax exemption number for the State of Connecticut is E-9613.

**Delaware**

N/A

**District of Columbia**

**WASHINGTON D.C. SALES TAX:**

*Add the following to the General Conditions:*

- **1** Materials that will be physically incorporated into and made a part of the Owner’s real property may be purchased by the Contractor free of Washington D.C. sales tax.

- **2** The Owner’s tax exempt number is 8661-0185848-001.
3. Contractor is responsible for submitting the Tax Exempt Purchase Certificate Form for real property projects on behalf of the Owner.

**Florida**

**NOTICE OF COMMENCEMENT**

*Add the following to the General Conditions:*

Before commencing the Project, Contractor shall record a notice of commencement in the clerk’s office and post a certified copy thereof. The notice of commencement shall substantially comply with the form in Florida Statutes 713.13 and contain the following information:

1. A description sufficient for identification of the real property to be improved. The description should include the legal description of the property and also should include the street address and tax folio number of the property if available or, if there is no street address available, such additional information as will describe the physical location of the real property to be improved.
2. A general description of the improvement.
3. The name and address of the owner, the owner’s interest in the site of the improvement, and the name and address of the fee simple titleholder, if other than such owner. A lessee who contracts for the improvements is an owner as defined under Florida Statutes s. 713.01(23) and must be listed as the owner together with a statement that the ownership interest is a leasehold interest.
4. The name and address of the contractor.
5. The name and address of the surety on the payment bond under Florida Statutes s. 713.23, if any, and the amount of such bond.
6. The name and address of any person making a loan for the construction of the improvements.
7. The name and address within the state of a person other than himself or herself who may be designated by the owner as the person upon whom notices or other documents may be served under this part; and service upon the person so designated constitutes service upon the owner.

A copy of the payment bond, if any, must be attached at the time of recordation of the notice of commencement.

**PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND**

*Add the following provisions as section 11.2(D); (E); and (F) of the General Conditions:*

11.2 PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

D. The payment bond shall be furnished by the contractor in at least the amount of the original contract price before commencing the construction of the improvement under the Agreement, and a copy of the bond shall be attached to the notice of commencement when the notice of commencement is recorded. The bond shall be executed as surety by a surety insurer authorized to do business in Florida.

E. The payment bond shall also include the following language:

THE CONDITION OF THIS BOND is that if Principal:

1. Promptly makes payment to all lienors supplying labor, material, and supplies used directly or indirectly by Principal in the prosecution of the work provided in the Agreement, the Agreement being made a part of this bond by reference; and
2. Pays Owner all loss, damage, expenses, costs, and attorney’s fees, including appellate proceedings, that Owner sustains because of default by Principal under paragraph 1 of this bond;

Then this bond is void; otherwise, it remains in full force.

F. The Owner, Contractor, and/or Surety shall furnish a true copy of the bond at the cost of reproduction to any lienor demanding it.
Idaho

RETENTION APPLIED TO CONTRACTOR PAYMENTS FOR PROJECTS IN IDAHO:

Replace section 9.5.F of the General Conditions with the following:

F. In addition and notwithstanding the foregoing, Owner may also withhold and retain 5% of payments made to Contractor.

PAYMENT OF RETAINED FUNDS IN IDAHO:

Replace section 9.5 G of the General Conditions with the following:

G. Owner will pay any unpaid retention less any amounts withheld pursuant to Section 9.4 within thirty (30) days after Contractor achieves Substantial Completion, submits its payment request for retained funds, delivers to the Architect Owner’s form entitled “Contractor’s Substantial Completion Affidavit and Consent of Surety” fully executed by Contractor and its surety, obtains Waiver and Release documents executed by all subcontractors and suppliers having claim against the retained funds, and Owner receives a certificate of occupancy.

Illinois

ILLINOIS STATE PROGRESS PAYMENTS AND FINAL PAYMENT:

Add the following as section 9.4.A.8 of the General Conditions:

9.4 DECISION TO WITHHOLD CERTIFICATION AND PAYMENT

8. Contractor’s failure to provide the notice to Owner as required under section 3.16.

Add the following as section 9.5.H of the General Conditions:

9.5 PROGRESS PAYMENTS

H. Notwithstanding any provision to the contrary, Owner is not required to make payments to Contractor until Contractor provides Owner sufficient evidence of Contractor’s compliance with the notices required by section 3.16.

NOTICE OF SUBCONTRACTORS FOR PROJECTS IN ILLINOIS:

Add the following as section 3.16 of the General Conditions:

3.16 CONTRACTOR TO PROVIDE NOTICE OF SUBCONTRACTORS

Contractor shall provide to Owner a statement of names and addresses of all those furnishing for this Project labor, services, material, fixtures, apparatus or machinery, and form or forms work, as well as the amounts due or to become due to such persons / entities. Such notice shall be in writing and under oath or verified by affidavit.

ILLINOIS STATE SALES TAX:

Add the following to the General Conditions:

1. Sales of materials to construction contractors for incorporation into the Owner’s real estate may be exempt from Illinois state sales tax. (Sales of tools, fuel, lumber for forms, and other end use
or consumption items to contractors who do not incorporate these items into real estate are subject to Illinois state sales tax.)

2. Contractor will obtain and provide subcontractors and suppliers with a certificate that
   - States the construction contractor’s purchases are for conversion into real estate under a contract with the Owner;
   - Identifies the Owner by name and address; and
   - States on what date the contract was entered into.

   The Contractor will also provide subcontractors and suppliers with the sales tax exemption number for Owner. The Owner’s sales tax exemption number for the State of Illinois is E9986-4045-06.

**Indiana**

**INDIANA STATE SALES TAX:**

Add the following to the General Conditions:

1. Purchase of materials and supplies should be exempt from Indiana state sales tax. The Owner’s sales tax exemption number for the State of Indiana is 7343965.

**Iowa**

N/A

**Kansas**

**RETENTION APPLIED TO CONTRACTOR PAYMENTS FOR PROJECTS IN KANSAS:**

Replace section 9.5.F of the General Conditions with the following:

F In addition and notwithstanding the foregoing, Owner may also withhold and retain 5% of payments made to Contractor.

**PAYMENT OF RETAINED FUNDS IN KANSAS:**

Replace section 9.5 G of the General Conditions with the following:

G. Owner will pay any unpaid retention less any amounts withheld pursuant to Section 9.4 within thirty (30) days after Contractor achieves Substantial Completion, submits its payment request for retained funds, delivers to the Architect Owner’s form entitled “Contractor’s Substantial Completion Affidavit and Consent of Surety” fully executed by Contractor and its surety, obtains Waiver and Release documents executed by all subcontractors and suppliers having claim against the retained funds, and Owner receives a certificate of occupancy.

**KANSAS STATE SALES TAX:**

Add the following to the General Conditions:

1. Upon obtaining a certificate of tax exemption for the project, an exemption from Kansas state sales tax should be allowed for tangible personal property and services purchased by Contractor for the project. Purchases of construction machinery, equipment or tools for the project are not exempt but rather are subject to state sales tax.

2. Prior to beginning work on the project, Contractor will assist the Owner in making a timely application to the State for a certificate of tax exemption for the project. After the certificate of tax exemption is obtained from the State, Contractor will furnish the number of the certificate to all suppliers from whom it makes purchases; and all such suppliers shall execute invoices covering the items purchased bearing the number of such certificate. In addition, upon completion of the project, Contractor will timely furnish to Owner a sworn statement (on the form provided by the Kansas Director of Taxation) that all purchases made under such exemption certificate were entitled to the tax exemption. All invoices for such tax
exempt purchases shall be held by Contactor for a period of five years.

**Kentucky**

RETENTION APPLIED TO CONTRACTOR PAYMENTS FOR PROJECTS IN KENTUCKY:

Replace section 9.5.F of the General Conditions with the following:

F. In addition and notwithstanding the foregoing, for payments to Contactor before the Project has reached fifty-one percent (51%) completion, Owner may withhold and retain 10% of such payments made to Contactor. For payments to Contactor after the Project has reached fifty-one percent (51%) completion, Owner may withhold and retain 5% of such payments made to the Contactor.

Replace section 9.5.G of the General Conditions with the following:

G. Owner will pay any unpaid retention less any amounts withheld pursuant to Section 9.4 within thirty (30) days after Contactor achieves Substantial Completion, submits its payment request for retained funds, delivers to the Architect Owner’s form entitled “Contractor’s Substantial Completion Affidavit and Consent of Surety” fully executed by Contactor and its surety, obtains Waiver and Release documents executed by all subcontractors and suppliers having claim against the retained funds, and Owner receives a certificate of occupancy.

**Louisiana**

N/A

**Maine**

MAINE STATE SALES TAX:

Add the following to the General Conditions:

1. The General Contractor should be exempt from Maine state sales tax on its purchases for this project.

2. The Owner’s tax exempt number is 20460.

**Maryland**

RETENTION APPLIED TO CONTRACTOR PAYMENTS FOR PROJECTS IN MARYLAND:

Replace section 9.5.F of the General Conditions with the following:

F. In addition and notwithstanding the foregoing, Owner may also withhold and retain 5% of payments made to Contactor.

MARYLAND STATE SALES TAX:

Add the following to the General Conditions:

1. The General Contractor should be exempt from Maryland state sales tax on its purchases for this project.

2. The Owner’s tax exempt number is 29020063.

**Massachusetts**

MASSACHUSETTS STATE SALES TAX:

Add the following to the General Conditions:
1. The General Contractor and its subcontractors should be exempt from Massachusetts state sales tax on purchases for this project. Contractors will obtain and complete state form ST-5C and submit it to Owner for signature and return. Contractor will then use the completed Purchase Certificate in making purchases for this Project.

2. The Owner’s tax exempt number is E870-234-341.

**Michigan**

**NOTICE OF COMMENCEMENT**

*Add the following to the General Conditions:*

Before commencing the Project, Contractor shall record a Notice of Commencement in the office of the register of deeds for each county in which the real property to be improved is located and post a copy thereof in a conspicuous place on the property. The notice of commencement shall substantially comply with the form in Michigan Compiled Laws 570.1108 and contain the following information:

1. The legal description of the real property on which the improvement is to be made conforming with Michigan Compiled Laws sections 560.212 and 560.255.
2. The name, address, and capacity of the signor for the Owner.
3. The name and address of Owner’s designee signing on behalf of Owner.
4. The name and address of the general contractor, if any.
5. The following statement:
   
   To lien claimants and subsequent purchasers:

   Take notice that work is about to commence on an improvement to the real property described in this instrument. A person having a construction lien may preserve the lien by providing a notice of furnishing to the above-named designee and the general contractor, if any, and by timely recording a claim of lien, in accordance with law.

   A person having a construction lien arising by virtue of work performed on this improvement should refer to the name of the Owner or lessee and the legal description appearing in this Notice. A person subsequently acquiring an interest in the land described is not required to be named in a claim of lien.

   A copy of this Notice with an attached form for notice of furnishing may be obtained upon making a written request by certified mail to the above-named Owner or lessee; the designee; or the person with whom you have contracted.

6. The name and address of the person preparing the Notice.
7. An affidavit of the Owner or the agent of the Owner which verifies the Notice.

Contractor must provide to Owner a copy of the Notice as well as prepare and provide to Owner the Affidavit verifying the Notice for Owner’s signature no later than seven (7) days prior to the time Contractor needs to receive the Affidavit back from Owner in order for Contractor to timely finalize and record the Notice of Commencement with its attachments.

In addition to recording and posting the Notice of Commencement, Contractor shall provide the Notice of Commencement and a blank notice of furnishing (described in Michigan Compiled Laws 570.1108), from time to time, to the property Owner as well as all subcontractors, laborers, or suppliers who request the Notice of Commencement.

**CONTRACTOR TO PROVIDE SWORN STATEMENTS**

Notwithstanding all other terms and conditions of the Contract Documents, Owner has the right (but no obligation) to require Contractor to submit to Owner a sworn statement that complies with Michigan Compiled Laws 570.1110 prior to the time payment is due or otherwise from time to time.

**Minnesota**
RETENTION APPLIED TO CONTRACTOR PAYMENTS FOR PROJECTS IN MINNESOTA:

Replace section 9.5.F of the General Conditions with the following:

F. In addition and notwithstanding the foregoing, Owner may also withhold and retain 5% of payments made to Contractor.

Mississippi
N/A

Missouri

PAYMENT OF RETAINED FUNDS IN MISSOURI:

Replace section 9.5 G of the General Conditions with the following:

G. Owner will pay any unpaid retention less any amounts withheld pursuant to Section 9.4 within thirty (30) days after Contractor achieves Substantial Completion, submits its payment request for retained funds, delivers to the Architect Owner’s form entitled “Contractor’s Substantial Completion Affidavit and Consent of Surety” fully executed by Contractor and its surety, obtains Waiver and Release documents executed by all subcontractors and suppliers having claim against the retained funds, and Owner receives a certificate of occupancy.

MISSOURI STATE SALES TAX:

Add the following to the General Conditions:

1. The Church of Jesus Christ of Latter-day Saints is a Religious Organization exempt from sales tax in accordance with Section 144.062 RSMO as modified by the 1994 Missouri General Assembly.

2. The Owner will furnish a ‘Missouri Project Exemption Certificate’ and a MO Tax Exemption Letter’ to the Contractor.

3. The Owner’s tax exempt number is 12473863.

Montana

RETENTION APPLIED TO CONTRACTOR PAYMENTS FOR PROJECTS IN MONTANA:

Replace section 9.5.F of the General Conditions with the following:

F In addition and notwithstanding the foregoing, Owner may also withhold and retain 5% of payments made to Contractor.

Nebraska

NEBRASKA STATE SALES TAX:

Add the following to the General Conditions:

1. Pursuant to applicable laws, Contractor will make application to The Nebraska Department of Revenue to act as prime contractor for approval to use Owner’s tax exempt number to permit the purchase of building materials for construction of this Project without payment of sales and use tax. Contractor may delegate its authority to its subcontractors as allowed by law to act as the purchasing agent for tax exemption purposes. Subcontractors shall follow the same application and compliance requirements as the Contractor. Applications will be on forms provided by The Nebraska Department of Revenue.

2. Prior to start of construction, Contractor will furnish copies of the submitted application forms to Owner.
**Nevada**

NEVADA NOTICE OF COMPLETION:

*Add the following to the General Conditions:*

A. Within five (5) calendar days of final completion of the Project and in compliance with Section 108.228 Nevada Revised Statutes, Contractor shall, on behalf of the Owner, file with the office of the county recorder of the county where the property is located, and copy to Owner, a notice of completion which shall include, without limitation, the following:
   1. The date of completion of the work of improvement;
   2. The owner’s name, the address of the owner, and the nature of the title of any person signing the notice;
   3. A description of the property sufficient for identification;
   4. The name of the prime contractor or contractors, if any.
   Contractor shall verify the notice of completion on the Owner’s behalf.

B. Upon recording the notice, Contractor shall within ten (10) days deliver a copy of the notice by certified mail to each prime contractor and each potential lien claimant who, before the notice was recorded, either submitted a request to the owner to receive the notice or delivered a preliminary notice of right to lien.

C. Notwithstanding any other provision of the Contract Documents to the contrary, Contractor and Owner agree that any breach or failure to comply with this Section by the Contractor will constitute a breach of contract and the Contractor will be liable for any direct, indirect, or consequential damages to the Owner flowing from this breach.

RETENTION APPLIED TO CONTRACTOR PAYMENT FOR PROJECTS IN NEVADA:

*Replace section 9.5.F of the General Conditions with the following:*

F. In addition and notwithstanding the foregoing, Owner may also withhold and retain 5% of payments made to Contractor.

**New Hampshire**

N/A

**New Jersey**

NEW JERSEY STATE SALES TAX:

*Add the following to the General Conditions:*

1. The General Contractor should be exempt from New Jersey state sales tax on its purchases for this project.

2. The Owner’s tax exempt number is EO-237-300-405.

**New Mexico**

RETENTION APPLIED TO CONTRACTOR PAYMENTS FOR PROJECTS IN NEW MEXICO:

Delete section 9.5 F of the General Conditions.

NEW MEXICO STATE PROGRESS PAYMENTS AND FINAL PAYMENT:

*Replace Sections 9.5 subsections A, C and G of the General Conditions with the following:*
9.5 PROGRESS PAYMENTS

A. Owner will pay Contractor progress payments within the parameters of Sections 9.2 through 9.4 within twenty-one (21) days after Owner receives the certified payment request from Architect.

C. Contractor and all Subcontractors will, within seven (7) days after receipt of payment, pay to their subcontractors and suppliers the amounts paid for work performed and materials supplied on the construction project.

G. Owner will pay any unpaid retention less any amounts withheld pursuant to Section 9.4 within twenty-one (21) days after Contractor submits its undisputed payment request for retained funds and delivers to Architect Owner’s form entitled “Contractor’s Substantial Completion Affidavit and Consent of Surety” fully executed by Contractor and its surety.

Replace Section 9.6. subsection A of the General Conditions with the following:

9.6 FINAL PAYMENT

A. Owner will make full and final payment within twenty-one (21) days of the completion of all of the following requirements:
   1. Contractor has submitted to Owner Contractor’s final payment request;
   2. Architect has declared to Owner in writing that the Work is complete; and
   3. Contractor has obtained waiver and release upon final payment documents executed by all of the subcontractors performing work and/or providing materials covered by the Contractor’s final payment request; and
   4. Contractor has provided to Owner all manufacturers’ and other warranties and guaranties, properly signed and endorsed to Owner, that are required by the Contract Documents. (Delivery of such guaranties and warranties will not relieve Contractor of any obligation assumed under any other provision of the Contract Documents.)

PAYMENT OF SUBCONTRACTORS AND MATERIALMEN FOR PROJECTS IN NEW MEXICO:

Replace Section 5.2.B of the General Conditions with the following:

5.2 SUBCONTRACTUAL RELATIONS

B. Contractor agrees to make prompt payment to its Subcontractors within seven (7) days of Contractor’s receipt of payment from Owner for that portion of the funds received which represents the Subcontractor’s portion of the Work completed to Contractor’s satisfaction for which payment was made by Owner. Failure of Contractor to make payment within that seven (7) day period will subject Contractor to pay interest to its Subcontractors on the undisputed amount at one and one-half percent per month or fraction of a month until payment is issued. Contractor agrees to require of its Subcontractors that they make prompt payment to their subcontractors within seven (7) days of their receipt of payment from the Contractor for that portion of the funds received which represents their subcontractor’s portion of the Work completed and to be subject to interest at one and one-half percent per month on undisputed amounts not paid to their subcontractors within that seven (7) day period.

New York

PAYMENT OF RETAINED FUNDS IN NEW YORK:

Replace section 9.5 G of the General Conditions with the following:

G. Owner will pay any unpaid retention less any amounts withheld pursuant to Section 9.4 within thirty (30) days after Contractor achieves Substantial Completion, submits its payment request for retained funds, delivers to the Architect Owner’s form entitled “Contractor’s Substantial Completion Affidavit and Consent of Surety” fully executed by Contractor and its surety, obtains Waiver and Release documents executed by all subcontractors and suppliers having claim against the retained funds, and Owner receives a certificate of occupancy.
NEW YORK STATE SALES TAX:

Add the following to the General Conditions:

1. Exemption from tax is allowed for materials sold to the Contractor for this project. For equipment rentals as well as any materials not used in the building, the Contractor is subject to New York sales tax.

2. The Owner’s tax exempt number is 105318.

North Carolina

NORTH CAROLINA STATE SALES TAX:

Add the following to the General Conditions:

1. At end of each calendar quarter, Contractor will provide Owner with the following information from invoices for materials and sub-contract work where North Carolina sales tax has been paid:
   a. Date of invoice
   b. Amount of tax
   c. Name and address of person or company.

LIEN AGENT

Add the following to the General Conditions:

Where the Contract Sum exceeds Thirty Thousand Dollars ($30,000), Contractor on behalf of Owner shall, simultaneous with the execution of the Agreement and at Contractor’s sole expense, obtain and maintain throughout the duration of the Project a lien agent for the Project in satisfaction of North Carolina statutes G.S. § 44A-11.1 & § 44A-11.2. In addition, Contractor shall satisfy all notice requirements under applicable law regarding the lien agent, including, without limitation, providing written information of the lien agent in the building permit and/or on a sign posted and maintained on the Project Site.

North Dakota

RETENTION APPLIED TO CONTRACTOR PAYMENTS FOR PROJECTS IN NORTH DAKOTA:

Replace section 9.5 F of the General Conditions with the following:

F. In addition and notwithstanding the forgoing, Owner may also withhold and retain 10% of payments made to Contractor until the work is 50% complete. Thereafter, Owner may continue to hold such retained amounts until completion but no additional retainage based solely on a percentage of the payments being made will be withheld from future payments.

Ohio

OHIO STATE SALES TAX:

Add the following to the General Conditions:

1. Contractor’s purchases of materials to be used for this project should be exempt from Ohio state sales tax. Contractor will issue exemption certificates to suppliers.

OHIO STATE NOTICE OF COMMENCEMENT:

Add the following to the General Conditions:

1. In accordance with State of Ohio lien laws, Owner may file Notice of Commencement with the County Recorder of the county in which the Project is located and provide a copy of that
notice to Contractor. Contractor will be responsible for distributing notice to subcontractors and suppliers.

**Oklahoma**

**OKLAHOMA STATE SALES TAX**

Add the following to the General Conditions:

1. The General Contractor and its subcontractors should be exempt from Oklahoma state sales tax on purchases for this project.
2. The Owner will provide a copy of its exemption documentation.
3. In compliance with Oklahoma Rule 710:65-7-13, Contractor will, on the face of each invoice or sales receipt, set out the name of the Owner, that the purchases are being made on behalf of the Owner, and that the purchases are necessary for the completion of the Agreement.

**Oregon**

**RETENTION APPLIED TO CONTRACTOR PAYMENTS FOR PROJECTS IN OREGON:**

Replace section 9.5.F of the General Conditions with the following:

F In addition and notwithstanding the foregoing, Owner may also withhold and retain 5% of payments made to Contractor.

**PAYMENT OF RETAINED FUNDS IN OREGON:**

Replace section 9.5 G of the General Conditions with the following:

G. Owner will pay any unpaid retention less any amounts withheld pursuant to Section 9.4 within thirty (30) days after Contractor achieves Substantial Completion, submits its payment request for retained funds, delivers to the Architect Owner’s form entitled “Contractor’s Substantial Completion Affidavit and Consent of Surety” fully executed by Contractor and its surety, obtains Waiver and Release documents executed by all subcontractors and suppliers having claim against the retained funds, and Owner receives a certificate of occupancy.

**Pennsylvania**

**PAYMENT OF RETAINED FUNDS IN PENNSYLVANIA:**

Replace section 9.5 G of the General Conditions with the following:

G. Owner will pay any unpaid retention less any amounts withheld pursuant to Section 9.4 within thirty (30) days after Contractor achieves Substantial Completion, submits its payment request for retained funds, delivers to the Architect Owner’s form entitled “Contractor’s Substantial Completion Affidavit and Consent of Surety” fully executed by Contractor and its surety, obtains Waiver and Release documents executed by all subcontractors and suppliers having claim against the retained funds, and Owner receives a certificate of occupancy.

**PENNSYLVANIA STATE SALES TAX:**

Add the following to the General Conditions:

1. Sales of certain materials to construction contractors for incorporation into the Owner’s real estate may be exempt from Pennsylvania state sales tax. Pennsylvania law 72 P.S. § 7201 allows construction contractors to claim the Owner’s sales tax exemption for “Building Machinery and Equipment” that is transferred pursuant to the construction contract to the Owner. “Building Machinery and Equipment” is “[g]eneration equipment, storage equipment, conditioning equipment, distribution equipment and termination equipment” limited to the following:
i. air conditioning limited to heating, cooling, purification, humidification, dehumidification and ventilation;
ii. electrical;
iii. plumbing;
iv. communications limited to voice, video, data, sound, master clock and noise abatement;
v. alarms limited to fire, security and detection;
vi. control system limited to energy management, traffic and parking lot and building access;
vii. medical system limited to diagnosis and treatment equipment, medical gas, nurse call and doctor paging;
viii. laboratory system;
ix. cathodic protection system; or
x. furniture, cabinetry and kitchen equipment.

The definition also explicitly includes: boilers, chillers, air cleaners, humidifiers, fans, switchgear, pumps, telephones, speakers, horns, motion detectors, dampers, actuators, grills, registers, traffic signals, sensors, card access devices, guardrails, medial devices, floor troughs and grates and laundry equipment, together with integral coverings and enclosures, whether or not the item constitutes a fixture or is otherwise affixed to the real estate whether or not damage would be done to the item or its surroundings upon removal or whether or not the item is physically located within a real estate structure.

However, the term "building machinery and equipment" shall not include guardrail posts, pipes, fittings, pipe supports and hangers, valves, underground tanks, wire, conduit, receptacle and junction boxes, insulation, ductwork and coverings thereof.

2. Contractor will obtain and provide subcontractors with Pennsylvania Exemption Certificates—Pennsylvania Form Rev-1220 AS—to be filled out and used when purchasing tax-exempt “Building Machinery and Equipment” for the project. For purposes of filling out Form Rev-1220 AS, the Owner’s tax exempt number is 75-259-773.

3. If Contractor or any subcontractor fails to obtain a sales-tax exemption when purchasing “Building Machinery and Equipment,” the Contractor or subcontractor shall be responsible for seeking its own refund of sales tax expending by filing a Refund Petition with the Pennsylvania Department of Revenue Board of Appeals.

**Rhode Island**

**RHODE ISLAND STATE SALES TAX:**

Add the following to the General Conditions:

1. Exemption from Rhode Island state sales tax should be allowed for materials purchased by Contractor for this project. Equipment rentals as well as materials not used in the building are subject to state sales tax.

2. The Owner’s tax exempt number is 11034.

**South Carolina**

N/A

**South Dakota**

N/A

**Tennessee**

RETENTION APPLIED TO CONTRACTOR PAYMENTS FOR PROJECTS IN TENNESSEE:
Replace section 9.5.F and G of the General Conditions with the following:

F. In addition and notwithstanding the foregoing, Owner may also withhold and retain five percent (5%) of payments made to Contractor. These retained funds will be released upon the expiration, discharge, or satisfaction of all liens and pursuant to the requirements set forth in Section 9.6.A. In the event the Contract Sum is $500,000 or greater, the retained funds will be placed in a separate interest bearing escrow account.

PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND FOR PROJECTS IN TENNESSEE:

Replace section 11.2. of the General Conditions with the following -

11.2 PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

A. Prior to commencement of the Work or within ten (10) days after signing the Agreement, whichever is earlier, Contractor will furnish to Owner the following bonds as security for all obligations arising under the Contract Documents: (1) a performance bond in an amount equal to one hundred percent (100%) of the Contract Sum; (2) A labor and material payment bond, which the Contractor will ensure shall: (a) be in a penal sum at least equal to one hundred percent (100%) of the Contract Sum, (b) be in favor of the Owner, (c) have the written approval of the Owner endorsed on it, (d) be executed by the Contractor as principal and by a corporate surety authorized and admitted to do business in the state of Tennessee and license by the state of Tennessee to executed bonds as surety, (e) be conditioned on prompt payment for every laborer, subcontractor or materialman contracted with or employed to work on buildings, fixtures, machinery, or improvements, or to furnish materials for the same, whether such laborer, subcontractor or materialman was employed or contracted with by the person who originally contracted with the Owner of the premises, or by an immediate or remote subcontractor acting under contract with the Contractor, or any subcontractor, and (f) be conditioned on prompt payment for usual extras not exceeding fifteen percent (15%) of the Contract Sum. In addition, the payment bond shall be amended to indicate the following on the face of the bond: “This Payment Bond is hereby amended and modified so as to be deemed to comply with all requirements of Tennessee Code section 66-11-142(b).”

In addition, the performance and payment bonds will:

1. Be written on Form AIA Document A312 (1984);
2. Be issued by a surety company or companies licensed in the state in which the Project is located and holding valid certificates of authority under Sections 9304 to 9308, Title 31, of the United States Code as acceptable sureties or reinsurance companies on federal bonds.
3. Have a penal sum obligation not exceeding the authorization shown in the current revision of Circular #570 as issued by the United States Treasury Department, i.e. “Treasury List”.
4. Be accompanied by a certified copy of the power of attorney stating the authority of the attorney-in-fact executing the bonds on behalf of the surety.

B. Owner reserves the right to reject any surety company, performance bond, or labor and material payment bond with or without cause.

C. The cost of the bonds as required above will be the obligation of Contractor.

D. At any time, Owner may record a copy of the payment bond with the register of deeds and/or other appropriate authority for the purpose of discharging any liens registered against the Owner’s property. Upon the recording of the payment bond with the register of deeds or other appropriate authority, Contractor and/or Owner shall notify the surety executing the bond of such bond recording for lien discharge. Contractor hereby consents to Owner’s recording, authorizes Owner to record, and/or designates Owner as Contractor’s agent for recording the payment bond to discharge liens. Contractor also consents, authorizes, and designates Owner to provide notification to the surety. Notwithstanding, such consents, authorizations and designations do not preclude or nullify a recording of the payment bond and attendant notification thereof to the surety by the Contractor.

Texas
RETENTION APPLIED TO CONTRACTOR PAYMENTS FOR PROJECTS IN TEXAS:

Replace section 9.5.F and G of the General Conditions with the following:

F. In addition and notwithstanding the foregoing, Owner may also withhold and retain 10% of payments made to Contractor. These retained funds will be released upon the expiration, discharge, or satisfaction of all liens and pursuant to the requirements set forth in Section 9.6.A.

TEXAS STATE SALES TAX:

Add the following to the General Conditions:

1. The Church of Jesus Christ of Latter-day Saints is a Religious Organization exempt from sales tax under Texas Tax Code §151.310. The general Contractor, when purchasing materials and equipment for this Project, should advise the vendors that Owner is an exempt organization and that no sales tax will be paid.

PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND FOR PROJECTS IN TEXAS:

Replace section 11.2 of the General Conditions with the following -

11.2 PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

A. Prior to commencement of the Work or within ten (10) days after signing the Agreement, whichever is earlier, Contractor will furnish to Owner the following bonds as security for all obligations arising under the Contract Documents: (1) a performance bond in an amount equal to one hundred percent (100%) of the Contract Sum; (2) A labor and material payment bond, which the Contractor will ensure shall: (a) be in a penal sum at least equal to one hundred percent (100%) of the Contract Sum, (b) be in favor of the Owner, (c) have the written approval of the Owner endorsed on it, (d) be executed by the Contractor as principal and by a corporate surety authorized and admitted to do business in the state of Texas and licensed by the state of Texas to execute bonds as surety, (e) be conditioned on prompt payment for all labor, subcontracts, materials, specially fabricated materials, and normal and usual extras not exceeding 15 percent of the Contract Sum; and (f) clearly and prominently display on the bond or on an attachment to the bond either: (i) the name, mailing address, physical address, and telephone number, including the area code, of the surety company to which any notice of claim should be sent; or (ii) the toll-free number maintained by the Texas Department of Insurance under Subchapter B, Chapter 521, Insurance Code, and a statement that the address of the surety company to which any notice of claim should be sent may be obtained from the Texas Department of Insurance by calling the toll-free telephone number.

In addition, the performance and payment bonds will:

2. Be issued by a surety company or companies licensed in the state in which the Project is located and holding valid certificates of authority under Sections 9304 to 9308, Title 31, of the United States Code as acceptable sureties or reinsurance companies on federal bonds.
3. Have a penal sum obligation not exceeding the authorization shown in the current revision of Circular #570 as issued by the United States Treasury Department, i.e. “Treasury List.”
4. Be accompanied by a certified copy of the power of attorney stating the authority of the attorney-in-fact executing the bond on behalf of the surety or sureties.

B. Owner reserves the right to reject any surety company, performance bond, or labor and material payment bond with or without cause.

C. The cost of the bonds as required above will be the obligation of Contractor.

D. Contractor will record the payment bond together with a copy of the Contract, with the county clerk in the county where the Project is located.

Utah
RETENTION APPLIED TO CONTRACTOR PAYMENTS FOR PROJECTS IN UTAH:

Replace section 9.5.F of the General Conditions with the following:

F. In addition and notwithstanding the foregoing, Owner may also withhold and retain 5% of payments made to Contractor. These retention funds will be held in an interest bearing account.

PAYMENT OF RETAINED FUNDS IN UTAH:

Replace section 9.5 G of the General Conditions with the following:

G. After Contractor achieves Substantial Completion and submits its payment request for retained funds and delivers to the Architect Owner’s form entitled “Contractor’s Substantial Completion Affidavit and Consent of Surety” fully executed by Contractor and its surety, if any, and provides statutory Conditional Waiver and Release documents executed by all subcontractors and suppliers having claim against the retained funds, Owner will pay any unpaid retention less any amounts withheld pursuant to Section 9.4 within forty-five (45) days from the later of (a) the date Owner received Contractor’s payment request for retained funds and fully executed Contractor’s Substantial Completion Affidavit and Consent of Surety, (b) the date a certificate of occupancy is issued; (c) the date that a building inspector having authority to issue its own certificate of occupancy does not issue that certificate but permits occupancy.

UTAH STATE SALES TAX:

Add the following to the General Conditions:

1. Contractors should be exempt on purchases of material installed or converted into real property to be used by the Owner. The Contractor will furnish each vendor with a completed Exemption Certificate Form TC-721. The certificate will be prepared by the Contractor for each vendor in order to obtain the exemption.

2. The Owner’s tax exempt number is 11871701-002-STC.

UTAH NOTICE OF INTENT TO OBTAIN FINAL COMPLETION:

Add the following to the General Conditions:

A. Contractor shall file with the State Construction Registry, on its own behalf and/or on behalf of Owner, a notice of intent to obtain final completion at least 45 days before the day on which the Owner or Contractor files or could file a notice of completion under Utah Code Ann. Section 38-1a-506 if:
   1. The completion of performance time under the original contract for construction work is greater than 120 days;
   2. The total original construction contract price exceeds $500,000; and
   3. The original contractor or owner has not obtained a payment bond in accordance with Utah Code Ann. Section 14-2-1.

UTAH NOTICE OF COMPLETION:

Add the following to the General Conditions:

A. Within five (5) calendar days of final completion of the Project and in compliance with Section 38-1a-507 Utah Code Annotated, Contractor shall file with the State Construction Registry, and copy to Owner, a notice of completion which shall include, without limitation, the following:
   1. The name, address, telephone number, and email address of the person filing the notice of completion;
   2. The name of the county in which the Project and/or Project site is located;
   3. The date on which final completion is alleged to have occurred;
   4. The method used to determine final completion; and
   5. One of the following:
a. The tax parcel identification number of each parcel included in the Project and/or Project site;
b. The entry number of a preliminary notice on the same project that includes the tax parcel identification number of each parcel included in the Project and/or Project site; or
c. The entry number of the building permit issued for the Project.

B. Notwithstanding any other provision of the Contract Documents to the contrary, Contractor and Owner agree that any breach or failure to comply with this Section by the Contractor will constitute a breach of contract and the Contractor will be liable for any direct, indirect, or consequential damages to the Owner flowing from this breach.

UTAH PROGRESS PAYMENTS AND FINAL PAYMENT:

Replace Section 9.5.A of the General Conditions with the following:

9.5 PROGRESS PAYMENTS

A. Owner will pay Contractor progress payments within the parameters of Section 9.2 within fifteen (15) days after:
   1. Contractor has submitted a progress payment request;
   2. Contractor has obtained Conditional Waiver and Release Upon Progress Payment documents (in content complying with Utah Code § 38-1a-802) executed by each of the subcontractors performing work and/or providing materials covered by the Contractor’s progress payment request; and
   3. Owner receives the certified payment request from Architect.

Replace Section 9.6.A.3 of the General Conditions with the following:

9.6 FINAL PAYMENT

3. Contractor has obtained Waiver and Release Upon Final Payment documents (in content complying with Utah Code § 38-1a-802) executed by each of the subcontractors performing work and/or providing materials covered by the Contractor’s final payment request;

Vermont

PAYMENT OF RETAINED FUNDS IN VERMONT:

Replace section 9.5 G of the General Conditions with the following:

G. Owner will pay any unpaid retention less any amounts withheld pursuant to Section 9.4 within thirty (30) days after Contractor achieves Substantial Completion, submits its payment request for retained funds, delivers to the Architect Owner’s form entitled “Contractor’s Substantial Completion Affidavit and Consent of Surety” fully executed by Contractor and its surety, obtains Waiver and Release documents executed by all subcontractors and suppliers having claim against the retained funds, and Owner receives a certificate of occupancy.

VERMONT STATE SALES TAX:

Add the following to the General Conditions:

1. Purchases of building materials and supplies should be exempt from Vermont state sales tax if those materials and supplies are consumed in the construction of this Project.

2. The Owner’s tax exempt number is 450-870234341F-01.

Virginia
N/A

Washington
WASHINGTON STATE CONTRACTOR DISCLOSURE NOTICE:

Add the following to the General Conditions:

1. For Projects in state of Washington, the Contractor will provide a 'job site' disclosure notice in accordance with Statute 60.04.230. Contractor will post this notice at the job site. This notice will detail the following:
   a. Legal description and street address of the construction site.
   b. Property Owner's name, address, and phone number as shown in the Contract Documents.
   c. Contractor's registration number and identification.
   d. Contractor's business name, address, and telephone number.

West Virginia
N/A

Wisconsin
N/A

Wyoming
N/A

END OF DOCUMENT
DIVISION 03 -- CONCRETE
03 1000 - Concrete Forming and Accessories
03 2000 - Concrete Reinforcing
03 3000 - Cast-in-Place Concrete
03 4500 - Precast Architectural Concrete
SECTION 03 1000
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.
   B. Form stripping.

1.02 RELATED REQUIREMENTS
   A. Section 03 2000 - Concrete Reinforcing.
   B. Section 03 3000 - Cast-in-Place Concrete.
   C. Section 04 2000 - Unit Masonry: Reinforcement for masonry.

1.03 REFERENCE STANDARDS
   A. ACI 301 - Specifications for Structural Concrete; 2016.

1.04 DELIVERY, STORAGE, AND HANDLING
   A. Deliver prefabricated forms and installation instructions in manufacturer’s packaging.
   B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.
   C. Protect plastic foam products from damage and exposure to sunlight.

PART 2 PRODUCTS
2.01 FORMWORK - GENERAL
   A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.
   B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.
   C. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 ERECTION - FORMWORK
   A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
   B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

3.03 FORM REMOVAL
   A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

END OF SECTION
SECTION 03 2000
CONCRETE REINFORCING

PART 1  GENERAL
1.01  SECTION INCLUDES
   A. Reinforcing steel for cast-in-place concrete.

1.02  RELATED REQUIREMENTS
   A. Section 03 3000 - Cast-in-Place Concrete.
   B. Section 04 2000 - Unit Masonry: Reinforcement for masonry.

1.03  REFERENCE STANDARDS

1.04  SUBMITTALS
   A. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

PART 2  PRODUCTS
2.01  REINFORCEMENT
   A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
      1. Deformed billet-steel bars.
      2. Galvanized in accordance with ASTM A767/A767M, Class I.

2.02  FABRICATION
   A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

PART 3  EXECUTION
3.01  PLACEMENT
   A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
   B. Comply with applicable code for concrete cover over reinforcement.

END OF SECTION
SECTION 03 3000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Concrete formwork.
B. Floors and slabs on grade.
C. Concrete foundation walls.
D. Concrete reinforcement.

1.02 REFERENCE STANDARDS
B. ACI 301 - Specifications for Structural Concrete; 2016.
C. ACI 302.1R - Guide to Concrete Floor and Slab Construction; 2015.
E. ACI 308R - Guide to External Curing of Concrete; 2016.
K. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2011 (Reapproved 2017).
L. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017.

1.03 SUBMITTALS
A. Mix Design: Submit proposed concrete mix design.
B. Samples: Submit samples of underslab vapor retarder to be used.

PART 2 PRODUCTS

2.01 FORMWORK
A. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.

2.02 REINFORCEMENT MATERIALS
A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
   1. Type: Deformed billet-steel bars.
   2. Finish: Unfinished, unless otherwise indicated.
B. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch (1.29 mm).
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
2.03 CONCRETE MATERIALS
   A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
      1. Acquire cement for entire project from same source.
   B. Fine and Coarse Aggregates: ASTM C33/C33M.
      1. Acquire aggregates for entire project from same source.
   C. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ACCESSORY MATERIALS
   A. Underslab Vapor Retarder: Sheet material complying with ASTM E1745, Class A; stated by
      manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs.
      The use of single ply polyethylene is prohibited.
      1. Installation: Comply with ASTM E1643.
      2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive,
         mastic, prefabricated boots, etc., for sealing seams and penetrations.

2.05 CONCRETE MIX DESIGN
   A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

2.06 MIXING
   A. Transit Mixers: Comply with ASTM C94/C94M.
   B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not
      add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible
      slump.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION
   A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all
      applied loads until concrete is cured, and for easy removal without damage to concrete.
   B. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints
      minimum 6 inches (150 mm). Seal joints, seams and penetrations watertight with
      manufacturer's recommended products and follow manufacturer's written instructions. Repair
      damaged vapor retarder before covering.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS
   A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and
      accurately position, support, and secure in place to achieve not less than minimum concrete
      coverage required for protection.

3.04 PLACING CONCRETE
   A. Place concrete in accordance with ACI 304R.
   B. Place concrete for floor slabs in accordance with ACI 302.1R.
   C. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 SLAB JOINTING
   A. Locate joints as indicated on drawings.
   B. Anchor joint fillers and devices to prevent movement during concrete placement.
   C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total
      height equal to thickness of slab, set flush with top of slab.

3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES
   A. Maximum Variation of Surface Flatness:
      1. Exposed Concrete Floors: 1/4 inch (6 mm) in 10 feet (3 m).
2. Under Seamless Resilient Flooring: 1/4 inch (6 mm) in 10 feet (3 m).
3. Under Carpeting: 1/4 inch (6 mm) in 10 feet (3 m).

B. Correct the slab surface if tolerances are less than specified.

C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.07 CONCRETE FINISHING

A. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI 302.1R; thick floor coverings include quarry tile and ceramic tile with full bed setting system.
2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, thin set quarry tile, and thin set ceramic tile.
3. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

B. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1/8"/FT nominal.

3.08 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

END OF SECTION
SECTION 03 4500
PRECAST ARCHITECTURAL CONCRETE

PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Architectural precast concrete window heads.
   B. Supports, anchors, and attachments.

1.02 RELATED REQUIREMENTS
   A. Section 03 2000 - Concrete Reinforcing.

1.03 DELIVERY, STORAGE, AND HANDLING
   A. Handling: Lift and support precast units only from support points.
   B. Protect units to prevent staining, chipping, or spalling of concrete.

PART 2 PRODUCTS
2.01 PRECAST UNITS, GENERAL
   A. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI 318.
      1. Accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
      2. Provide connections that accommodate building movement and thermal movement and adjust to misalignment of structure without unit distortion or damage.

2.02 REINFORCEMENT
   A. Comply with requirements of Section 03 2000.

2.03 CONCRETE MATERIALS
   A. Cement: ASTM C150/C150M, Type I - Normal Portland type.

2.04 FABRICATION
   A. Fabricate in compliance with PCI MNL-117 and PCI MNL-135.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify that building structure, anchors, devices, and openings are ready to receive work of this section.

3.02 PREPARATION
   A. Provide for erection procedures and induced loads during erection. Maintain temporary bracing in place until final support is provided.

3.03 ERECTION
   A. Erect units without damage to shape or finish. Replace or repair damaged panels.
   B. Erect units level and plumb within allowable tolerances.

3.04 CLEANING
   A. Clean pre-cast heads.

3.05 PROTECTION
   A. Protect installed pre-cast heads from subsequent construction operations.

END OF SECTION
PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Concrete block.
   B. Clay facing brick.
   C. Common brick.
   D. Mortar and grout.
   E. Reinforcement and anchorage.
   F. Flashings.
   G. Lintels.
   H. Accessories.

1.02 RELATED REQUIREMENTS
   A. Section 03 2000 - Concrete Reinforcing: Reinforcing steel for grouted masonry.
   B. Section 03 3000 - Cast-in-Place Concrete: Installation of dovetail slots for masonry anchors.
   C. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 SUBMITTALS
   A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   B. Product Data: Provide data for masonry units and mortar.

1.04 DELIVERY, STORAGE, AND HANDLING
   A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS
2.01 CONCRETE MASONRY UNITS
   A. Concrete Block: Comply with referenced standards and as follows:
      1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depth of as shown in drawings.

2.02 BRICK UNITS
   A. Building (Common) Brick: ASTM C62, Grade SW; solid units.
      1. Nominal size: As indicated on drawings.

2.03 MORTAR AND GROUT MATERIALS
   A. Masonry Cement: ASTM C91/C91M, Type N.

2.04 REINFORCEMENT AND ANCHORAGE
   A. Reinforcing Steel: Type 60, as specified in Section 03 2000; size as indicated on drawings; galvanized finish.
   B. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
   C. Single Wythe Joint Reinforcement: ASTM A951/A951M.

2.05 ACCESSORIES
   A. Preformed Control Joints: Neoprene material. Provide with corner and tee accessories, fused joints.
   B. Weeps:
1. Type: Polyester mesh.
C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.06 LINTELS
A. Prefabricated Steel Lintels:

2.07 MORTAR AND GROUT MIXING
A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
   1. Masonry below grade and in contact with earth: Type S.
   2. Exterior, loadbearing masonry: Type N.
   3. Exterior, non-loadbearing masonry: Type N.
   4. Interior, loadbearing masonry: Type N.
   5. Interior, non-loadbearing masonry: Type O.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that field conditions are acceptable and are ready to receive masonry.
B. Verify that related items provided under other sections are properly sized and located.
C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION
A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COURSING
A. Establish lines, levels, and coursing indicated. Protect from displacement.
B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
D. Brick Units:
   1. Bond: Running.
   2. Coursing: Three units and three mortar joints to equal 8 inches (200 mm).

3.04 WEEPS/CAVITY VENTS
A. Install weeps in veneer and cavity walls at 16 inches (406 mm) on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

3.05 MASONRY FLASHINGS
A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

3.06 LINTELS
A. Install loose steel lintels over openings.

3.07 CONTROL AND EXPANSION JOINTS
A. Do not continue horizontal joint reinforcement through control or expansion joints.
B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
C. Size control joints as indicated on drawings; if not indicated, 3/4 inch (19 mm) wide and deep.
3.08 BUILT-IN WORK
   A. As work progresses, install built-in metal door frames and glazed frames and other items to be
      built into the work and furnished under other sections.
   B. Install built-in items plumb, level, and true to line.
   C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid
      with grout.

3.09 CLEANING
   A. Remove excess mortar and mortar droppings.
   B. Replace defective mortar. Match adjacent work.
   C. Clean soiled surfaces with cleaning solution.
   D. Use non-metallic tools in cleaning operations.

3.10 PROTECTION
   A. Without damaging completed work, provide protective boards at exposed external corners that
      are subject to damage by construction activities.

END OF SECTION
DIVISION 06 -- WOOD, PLASTICS, AND COMPOSITES
06 1000 - Rough Carpentry
06 1753 - Shop-Fabricated Wood Trusses
06 2000 - Finish Carpentry
06 4100 - Architectural Wood Casework
PART 1  GENERAL

1.01 SECTION INCLUDES
   A. Structural dimension lumber framing.
   B. Non-structural dimension lumber framing.
   C. Rough opening framing for doors, windows, and roof openings.
   D. Sheathing.

1.02 RELATED REQUIREMENTS
   A. Section 03 3000 - Cast-in-Place Concrete: Setting anchors in concrete.
   B. Section 07 2500 - Weather Barriers: Water-resistive barrier over sheathing.
   C. Section 07 6200 - Sheet Metal Flashing and Trim: Sill flashings.

1.03 REFERENCE STANDARDS
   C. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; 2010.

1.04 DELIVERY, STORAGE, AND HANDLING
   A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2  PRODUCTS

2.01 GENERAL REQUIREMENTS
   A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
      1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
      2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
   B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS
   A. Sizes: Nominal sizes as indicated on drawings, ________.
   B. Moisture Content: S-dry or MC19.
   C. Stud Framing (2 by 2 through 2 by 6 (50 by 50 mm through 50 by 150 mm)):
      1. Grade: No. 2.
   D. Joist, Rafter, and Small Beam Framing (2 by 6 through 4 by 16 (50 by 150 mm through 100 by 400 mm)):
      1. Species: Any allowed under grading rules.
   E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
      1. Lumber: S4S, No. 2 or Standard Grade.
      2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS
   A. Roof Sheathing: Any PS 2 type, rated Structural I Sheathing.
2. Span Rating: 60.
3. Performance Category: 3/4 PERF CAT.

B. Wall Sheathing: Oriented strand board wood structural panel; PS 2.

2.04 ACCESSORIES
A. Fasteners and Anchors:
B. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.
C. Sill Flashing: As specified in Section 07 6200.
D. Water-Resistive Barrier: As specified in Section 07 2500.
E. Building Paper: Water resistant Kraft paper.

PART 3 EXECUTION
3.01 PREPARATION
3.02 INSTALLATION - GENERAL
A. Select material sizes to minimize waste.
B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

3.03 FRAMING INSTALLATION
A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.
B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.
C. Install structural members full length without splices unless otherwise specifically detailed.
D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes, AWC (WFCM) Wood Frame Construction Manual, and ____________.
E. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.
F. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS
A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

3.05 INSTALLATION OF CONSTRUCTION PANELS
A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
   1. Nail panels to framing; staples are not permitted.

3.06 CLEANING
A. Waste Disposal: Comply with the requirements of Section 01 7419 - Construction Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.
B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION
SECTION 06 1753
SHOP-FABRICATED WOOD TRUSSES

PART 1  GENERAL

1.01  SECTION INCLUDES
A. Shop fabricated wood trusses for roof framing.
B. Bridging, bracing, and anchorage.

1.02  REFERENCE STANDARDS

1.03  SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Show truss configurations, sizes, spacing, size and type of plate connectors, cambers, framed openings, bearing and anchor details, and bridging and bracing.
   1. Provide shop drawings stamped or sealed by design engineer.
   2. Submit design calculations.

1.04  DELIVERY, STORAGE, AND HANDLING
A. Handle and erect trusses in accordance with TPI BCSI 1.
B. Store trusses in vertical position resting on bearing ends.

PART 2  PRODUCTS

2.01  TRUSSES
A. Wood Trusses: Designed and fabricated in accordance with TPI 1 and TPI DSB-89 to achieve structural requirements indicated.

2.02  MATERIALS
A. Lumber:
   1. Moisture Content: Between 7 and 9 percent.
   2. Lumber fabricated from old growth timber is not permitted.
B. Truss Bridging: Type, size and spacing recommended by truss manufacturer.

PART 3  EXECUTION

3.01  EXAMINATION
A. Verify that supports and openings are ready to receive trusses.

3.02  PREPARATION
A. Coordinate placement of bearing items.

3.03  ERECTION
A. Install trusses in accordance with manufacturer’s instructions and TPI DSB-89 and TPI BCSI 1; maintain a copy of each TPI document on site until installation is complete.
B. Set members level and plumb, in correct position.
C. Install permanent bridging and bracing.

END OF SECTION
SECTION 06 2000
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Finish carpentry items.
B. Wood door frames, glazed frames.
C. Wood casings and moldings.

1.02 RELATED REQUIREMENTS
A. Section 06 4100 - Architectural Wood Casework: Shop fabricated custom cabinet work.
B. Section 08 1416 - Flush Wood Doors.
C. Section 08 8000 - Glazing: Glass and glazing of wood partitions and screens.
D. Section 09 9113 - Exterior Painting: Painting and finishing of finish carpentry items.
E. Section 09 9123 - Interior Painting: Painting and finishing of finish carpentry items.

1.03 DELIVERY, STORAGE, AND HANDLING
A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS
A. Interior Woodwork Items:
   1. Moldings, Bases, Casings, and Miscellaneous Trim: Clear white pine; prepare for paint finish.

2.02 FABRICATION
A. Shop assemble work for delivery to site, permitting passage through building openings.
B. When necessary to cut and fit on site, provide materials with ample allowance for cutting.
   Provide trim for scribing and site cutting.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify adequacy of backing and support framing.

3.02 INSTALLATION
A. Set and secure materials and components in place, plumb and level.
B. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm).
   Do not use additional overlay trim to conceal larger gaps.

3.03 TOLERANCES
A. Maximum Variation from True Position: 1/16 inch (1.6 mm).
B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

END OF SECTION
SECTION 06 4100
ARCHITECTURAL WOOD CASEWORK

PART 1  GENERAL

1.01  SECTION INCLUDES
    A. Specially fabricated cabinet units.
    B. Countertops.
    C. Cabinet hardware.

1.02  REFERENCE STANDARDS
    A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2016).
    C. BHMA A156.9 - American National Standard for Cabinet Hardware; 2015.

1.03  SUBMITTALS
    A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
    B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details,
       and accessories.

1.04  DELIVERY, STORAGE, AND HANDLING
    A. Protect units from moisture damage.

PART 2  PRODUCTS

2.01  CABINETS
    A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI
       (NAAWS), unless noted otherwise.

2.02  WOOD-BASED COMPONENTS
    A. Wood fabricated from old growth timber is not permitted.

2.03  LAMINATE MATERIALS
    A. Manufacturers:
       1. Formica Corporation; ____:  www.formica.com/#sle.

2.04  COUNTERTOPS
    A. Plastic Laminate Countertops: Medium density fiberboard substrate covered with HPDL,
       conventionally fabricated and self-edge banded.

2.05  ACCESSORIES
    A. Adhesive: Type recommended by fabricator to suit application.
    B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated
       tongue; of width to match component thickness.

2.06  HARDWARE
    A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
    B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf
       standards or multiple holes for pin supports and coordinated self rests, polished chrome finish,
       for nominal 1 inch (25 mm) spacing adjustments.
    C. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers ("U"
       shaped wire pull, steel with chrome finish, 100 mm centers).
    D. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
E. Catches: Magnetic.

F. Drawer Slides:
   1. Type: Standard extension.
   2. Static Load Capacity: Commercial grade.
   4. Stops: Integral type.

G. Hinges: European style concealed self-closing type, steel with polished finish.

2.07 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION
DIVISION 07 -- THERMAL AND MOISTURE PROTECTION

07 2100 - Thermal Insulation
07 2500 - Weather Barriers
07 3113 - Asphalt Shingles
07 6200 - Sheet Metal Flashing and Trim
07 7123 - Manufactured Gutters and Downspouts
07 9200 - Joint Sealants
SECTION 07 2100
THERMAL INSULATION

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Board insulation at perimeter foundation wall.
B. Batt insulation and vapor retarder in exterior wall, ceiling, and roof construction.
C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.04 FIELD CONDITIONS
A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS
2.01 APPLICATIONS
A. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.

2.02 FOAM BOARD INSULATION MATERIALS
A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
   1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   3. Type and Thermal Resistance, R-value (RSI-value): Type IV, 5.0 (0.88) per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature.

2.03 BATT INSULATION MATERIALS
A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor's option.
B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
   1. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
C. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
   1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
PART 3  EXECUTION

3.01  EXAMINATION
A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02  BOARD INSTALLATION AT FOUNDATION PERIMETER
A. Install boards horizontally on foundation perimeter.
B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03  BATT INSTALLATION
A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.04  PROTECTION
A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION
SECTION 07 2500  
WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water-Resistive Barrier: Under exterior wall cladding, over sheathing or other substrate; not air tight or vapor retardant.

B. Vapor Retarders: Materials to make exterior walls, joints between exterior walls and roof, joints around frames of openings in exterior walls, and ____ water vapor resistant and air tight.

C. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, joints around frames of openings in exterior walls, and ____.

1.02 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

1.03 REFERENCE STANDARDS


1.04 SUBMITTALS

A. Product Data: Provide data on material characteristics.

B. Manufacturer's Installation Instructions: Indicate preparation.

1.05 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

A. Water-Resistive Barrier: Provide on exterior walls under exterior cladding.

B. Air Barrier:

C. Exterior Vapor Retarder:
   1. On outside surface of sheathing use vapor retarder coating.

2.02 AIR BARRIER MATERIALS (AIR AND VAPOR BARRIER)

A. Air and Vapor Barrier Sheet, Self-Adhered:
   1. Air Permeance: 0.0002 cubic feet per minute per square foot (0.001 L/s/sq m), maximum, when tested in accordance with ASTM E2178.
   2. Water Vapor Permeance: 0.02 perms (1.14 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E96/E96M.
   3. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 30 days of weather exposure.
   4. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.
   5. Seam and Perimeter Tape: As recommended by sheet manufacturer.
2.03 ACCESSORIES
   A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION
   A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

3.03 INSTALLATION
   A. Install materials in accordance with manufacturer's instructions.
   B. Openings and Penetrations in Exterior Weather Barriers:
      1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches (125 mm) onto weather barrier and at least 6 inches (150 mm) up jambs; mechanically fasten stretched edges.
      2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches (100 mm) wide; do not seal sill flange.
      3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches (230 mm) wide, covering entire depth of framing.
      4. At head of openings, install flashing under weather barrier extending at least 2 inches (50 mm) beyond face of jambs; seal weather barrier to flashing.
      5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
      6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 PROTECTION
   A. Do not leave materials exposed to weather longer than recommended by manufacturer.
   B. Do not leave paper- or felt-based barriers exposed to weather for longer than one week.

END OF SECTION
SECTION 07 3113
ASPHALT SHINGLES

PART 1  GENERAL

1.01 SECTION INCLUDES
   A. Asphalt shingle roofing.
   B. Flexible sheet membranes for eave protection, underlayment, and valley protection.
   C. Associated metal flashings and accessories.

1.02 REFERENCE STANDARDS
   H. NRCA (RM) - The NRCA Roofing Manual; 2018.

1.03 SUBMITTALS
   A. Product Data: Provide data indicating material characteristics, performance criteria, and limitations.
   B. Manufacturer's Installation Instructions: Indicate installation criteria and procedures.
   C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 WARRANTY
   A. Correct defective Work within a five year period after Date of Substantial Completion.
   B. Provide lifetime manufacturer's warranty for coverage against black streaks caused by algae.
   C. Provide five year manufacturer's warranty for wind damage.

PART 2  PRODUCTS

2.01 ASPHALT SHINGLES
   A. Asphalt Shingles: Asphalt-coated glass felt, mineral granule surfaced, complying with ASTM D3462/D3462M.
      2. Wind Resistance: Class A, when tested in accordance with ASTM D3161/D3161M.

2.02 SHEET MATERIALS
   A. Roll Roofing:
      1. Mineral Surfaced Roll Roofing: Asphalt-coated organic felt, mineral granule surfaced, complying with ASTM D6380/D6380M, Class M, Type II, with 2 inch (50 mm) wide selvage; color as selected.
   B. Eave Protection Membrane:

C. Underlayment: Asphalt-saturated organic roofing felt, unperforated, complying with ASTM D226/D226M, Type I ("No.15").


2.03 ACCESSORIES
A. Roofing Nails: Standard round wire shingle type, galvanized steel, stainless steel, aluminum roofing nails, or copper roofing nails, minimum 3/8 inch (9.5 mm) head diameter, 12 gage, 0.109 inch (2.77 mm) nail shank diameter, 1-1/2 inch (38 mm) long and complying with ASTM F1667.

2.04 METAL FLASHINGS
A. Metal Flashings: Provide sheet metal eave edge, gable edge, ridge, ridge vents, open valley flashing, chimney flashing, dormer flashing, and other flashing indicated.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify existing conditions prior to beginning work.
B. Verify that roof deck is of sufficient thickness to accept fasteners.
C. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.
D. Verify roof openings are correctly framed.
E. Verify deck surfaces are dry, free of ridges, warps, or voids.

3.02 PREPARATION
A. Seal roof deck joints wider than 1/16 inch (1.5 mm) as recommended by shingle manufacturer.
B. At areas where eave protection membrane is to be adhered to substrate, fill knot holes and surface cracks with latex filler.
C. Broom clean deck surfaces before installing underlayment or eave protection.

3.03 INSTALLATION - EAVE PROTECTION MEMBRANE
A. Install eave protection membrane from eave edge to minimum 4 ft (1200 mm) up-slope beyond interior face of exterior wall.

3.04 INSTALLATION - UNDERLAYMENT
A. Underlayment At Roof Slopes Greater Than 4:12: Install underlayment perpendicular to slope of roof, with ends and edges weather lapped minimum 4 inches (100 mm), stagger end laps of each consecutive layer, nail in place, and weather lap minimum 4 inches (100 mm) over eave protection.
B. Weather lap and seal watertight with plastic cement any items projecting through or mounted on roof.

3.05 INSTALLATION - VALLEY PROTECTION
A. Install flexible flashing in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
B. Weather lap joints minimum 2 inches (50 mm).
C. Nail in place minimum 18 inches (450 mm) on center, 1 inch (25 mm) from edges.

3.06 INSTALLATION - METAL FLASHING AND ACCESSORIES
A. Install flashings in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
B. Weather lap joints minimum 2 inches (50 mm) and seal weather tight with plastic cement.
C. Secure in place with nails at 6 inches (6 mm) on center, and conceal fastenings.
D. Items Projecting Through or Mounted on Roofing: Flash and seal weather tight with plastic cement.

3.07 INSTALLATION - SHINGLES
A. Install shingles in accordance with manufacturer's instructions.
   1. Fasten individual shingles using two nails per shingle, or as required by manufacturer and local building code, whichever is greater.
   2. Fasten strip shingles using four nails per strip, or as required by manufacturer and local building code, whichever is greater.
B. Place shingles in straight coursing pattern with 5 inch (125 mm) weather exposure to produce double thickness over full roof area, and provide double course of shingles at eaves.
C. Project first course of shingles 3/4 inch (19 mm) beyond fascia boards.
D. Extend shingles 1/2 inch (13 mm) beyond face of gable edge fascia boards.
E. Complete installation to provide weather tight service.

END OF SECTION
SECTION 07 6200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL
1.01 SECTION INCLUDES
   A. Fabricated sheet metal items, including flashings, counterflashings, gutters, and downspouts.
   B. Sealants for joints within sheet metal fabrications.
   C. Precast concrete splash pads.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
   A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

PART 2 PRODUCTS
2.01 GUTTER AND DOWNSPOUT FABRICATION
   A. Gutters and Downspouts: Sizes indicated.
   B. Accessories: Profiled to suit gutters and downspouts.
      1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
      2. Gutter Supports: Straps.
   C. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3000 psi (21 MPa) at 28 days, with minimum 5 percent air entrainment.
   D. Seal metal joints.

2.02 ACCESSORIES
   A. Fasteners: Galvanized steel, with soft neoprene washers.
   B. Primer: Zinc chromate type.
   C. Concealed Sealants: Non-curing butyl sealant.
   D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
   E. Plastic Cement: ASTM D4586/D4586M, Type I.

PART 3 EXECUTION
3.01 EXAMINATION
   A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
   B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION
   A. Install starter and edge strips, and cleats before starting installation.

3.03 INSTALLATION
   A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.
   B. Apply plastic cement compound between metal flashings and felt flashings.
   C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

D. Secure gutters and downspouts in place with concealed fasteners.
E. Set splash pads under downspouts.

END OF SECTION
SECTION 07 7123
MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1  GENERAL

1.01 SECTION INCLUDES
A. Pre-finished aluminum gutters and downspouts.
B. Precast concrete splash pads.

1.02 RELATED REQUIREMENTS
A. Section 07 6200 - Sheet Metal Flashing and Trim.

1.03 REFERENCE STANDARDS
B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

1.04 SUBMITTALS
A. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation.  Slope to drain.
B. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2  PRODUCTS

2.01 MATERIALS
A. Pre-Finished Aluminum Sheet: ASTM B209 (ASTM B209M); 0.032 inch (0.8 mm) thick.
   1. Finish: Plain, shop pre-coated with modified silicone coating.
   2. Color: As indicated.

2.02 ACCESSORIES
A. Splash Pads: Precast concrete type, size and profiles indicated; minimum 3000 psi (21 MPa) at 28 days, with minimum 5 percent air entrainment.

2.03 FABRICATION
A. Form gutters and downspouts of profiles and size indicated.
B. Fabricate with required connection pieces.
C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance.  Allow for expansion at joints.
D. Hem exposed edges of metal.
E. Fabricate gutter and downspout accessories; seal watertight.

PART 3  EXECUTION

3.01 EXAMINATION
A. Verify existing conditions before starting work.
B. Verify that surfaces are ready to receive work.

3.02 INSTALLATION
A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.
B. Slope gutters 1/8 inch per foot (____ mm/m).
C. Set splash pans under downspouts.
PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Nonsag gunnable joint sealants.
   B. Joint backings and accessories.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
   A. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
      1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
      2. List of backing materials approved for use with the specific product.
      3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
      4. Substrates the product should not be used on.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS
   A. Scope:
      1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
         a. Wall expansion and control joints.
         b. Joints between door, window, and other frames and adjacent construction.
         c. Joints between different exposed materials.
         d. Openings below ledge angles in masonry.
         e. Other joints indicated below.
      2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
         a. Joints between door, window, and other frames and adjacent construction.
         b. Other joints indicated below.
      3. Do not seal the following types of joints.
         a. Intentional weepholes in masonry.
   B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
   C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.

2.02 NONSAG JOINT SEALANTS
   A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
      1. Movement Capability: 1/8, minimum.
      2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
      3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
      5. Cure Type: Single-component, neutral moisture curing.
B. Type ___ - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.

2.03 ACCESSORIES
   A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
   B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that joints are ready to receive work.
   B. Verify that backing materials are compatible with sealants.
   C. Verify that backer rods are of the correct size.

3.02 PREPARATION
   A. Remove loose materials and foreign matter that could impair adhesion of sealant.
   B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
   C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
   D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION
   A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
   B. Perform installation in accordance with ASTM C1193.
   C. Install bond breaker backing tape where backer rod cannot be used.
   D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
   E. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
   F. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

END OF SECTION
DIVISION 08 -- OPENINGS
08 1113 - Hollow Metal Doors and Frames
08 4313 - Aluminum-Framed Storefronts
08 5313 - Vinyl Windows
08 7100 - Door Hardware
08 8100 - Glazing
SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Non-fire-rated hollow metal doors and frames.
B. Thermally insulated hollow metal doors with frames.

1.02 REFERENCE STANDARDS
B. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.

1.03 SUBMITTALS
A. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.04 DELIVERY, STORAGE, AND HANDLING
A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS
2.01 DESIGN CRITERIA
A. Requirements for Hollow Metal Doors and Frames:
   1. Steel used for fabrication of doors and frames shall comply with one or more of the following requirements; Galvannealed steel conforming to ASTM A653/A653M, cold-rolled steel conforming to ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel conforming to ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.
B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.02 HOLLOW METAL DOORS
A. Door Finish: Factory primed and field finished.
B. Exterior Doors: Thermally insulated.
1. Door Thickness: 1-3/4 inch (44.5 mm), nominal.

C. Interior Doors, Non-Fire Rated:
1. Door Thickness: 1-3/4 inch (44.5 mm), nominal.
2. Door Face Sheets: Flush.

2.03 HOLLOW METAL FRAMES
A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
B. Frame Finish: Factory primed and field finished.
C. Exterior Door Frames: Face welded type.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
2. Frame Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
3. Weatherstripping: Separate, see Section 08 7100.
D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.

2.04 FINISHES
A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.05 ACCESSORIES
A. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify existing conditions before starting work.
B. Verify that opening sizes and tolerances are acceptable.
C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION
A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
B. Coordinate frame anchor placement with wall construction.
C. Install door hardware as specified in Section 08 7100.

3.03 ADJUSTING
A. Adjust for smooth and balanced door movement.

END OF SECTION
SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Aluminum-framed storefront, with vision glass.
B. Aluminum doors and frames.
C. Weatherstripping.
D. Door hardware.

1.02 RELATED REQUIREMENTS
A. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 SUBMITTALS
A. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
B. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

1.04 DELIVERY, STORAGE, AND HANDLING
A. Handle products of this section in accordance with AAMA CW-10.
B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.05 FIELD CONDITIONS
A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.06 WARRANTY
A. Correct defective Work within a five year period after Date of Substantial Completion.
B. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS
2.01 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING
A. Center-Set Style, Wind-Borne-Debris Resistance Tested:
   1. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep (50 mm wide by 114 mm deep).

2.02 BASIS OF DESIGN -- SWINGING DOORS
A. Wind-Borne-Debris Resistance Tested:
   1. Thickness: 1-3/4 inches (43 mm).
B. Medium Stile, Insulating Glazing, Thermally-Broken:
   1. Thickness: 1-3/4 inches (43 mm).

2.03 STOREFRONT
A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Finish: Superior performing organic coatings.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

2. Finish Color: Dark bronze.

3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.


5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

6. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.

8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

2.04 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.

B. Glazing: As specified in Section 08 8000.

C. Swing Doors: Glazed aluminum.
   1. Thickness: 1-3/4 inches (43 mm).
   2. Bottom Rail: 10 inches (254 mm) wide.
   4. Finish: Same as storefront.

2.05 MATERIALS


B. Fasteners: Stainless steel.

C. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.06 HARDWARE

A. For each door, include weatherstripping, sill sweep strip, and threshold.

B. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

C. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

D. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.
B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Set thresholds in bed of sealant and secure.

J. Install hardware using templates provided.

K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 ADJUSTING
A. Adjust operating hardware and sash for smooth operation.

3.04 CLEANING
A. Remove protective material from pre-finished aluminum surfaces.

3.05 PROTECTION
A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION
SECTION 08 5313
VINYL WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. Window units.

B. Related Requirements:
   2. Section 07 9213: 'Elastomeric Joint Sealants' for quality of sealant and backer rod.
   3. Section 08 4113: 'Aluminum-Framed Entrances And Storefront' for fixed storefront windows.
   4. Section 08 8100: 'Glass Glazing' for quality of glass glazing.

1.2 REFERENCES

A. Association Publications:
   1. American Architectural Manufacturers Association:
      a. AAMA 701/702-11, 'Voluntary Specifications for Pile Weatherstripping and Replaceable
         Fenestration Weatherseals'.
      b. AAMA 711-13, Voluntary Specification for Self-Adhering Flashing Used for Installation of
         Exterior Wall Fenestration Products.
      c. AAMA 851-09, 'Fenestration Sealants Guide for Windows, Window Walls and Curtain Walls'.
      d. AAMA 902-16, 'Voluntary Specification for Sash Balances',
      e. AAMA 910-16, 'Life Cycle Specifications and Test Methods for AW Class Architectural
         Windows and Doors'.

218036 Garden City Assembly 08 5313 - 1 VINYL WINDOWS
f. AAMA 1503-09, 'Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections'.
g. AAMA 2605-17a, 'Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Plastic Profiles'.

2. American Architectural Manufacturers Association / Window & Door Manufacturers Association / Canadian Standards Association:

3. Fenestration Manufacturers Association / American Architectural Manufacturers Association:
a. FMA/AAMA100-12, 'Standard Practice for the Installation of Windows with Flanges or Mounting Fins in Wood Frame Construction'.

4. National Fenestration Rating Council, Silver Spring, MD:
a. NFRC 200-2014, Section 5.6 (Non-Residential Fenestration).
b. NFRC Certification Program.

B. Definitions:
1. Air Leakage: Flow of air which passes through fenestration products.
2. Fenestration: Openings in or on the building envelope, such as windows, doors, secondary storm products (SSPs) curtain walls, storefronts, roof windows, tubular daylighting devices (TDDs), sloped glazing, and skylights, designed to permit the passage of air, light, or people.
3. Obscure Glass: Adds privacy where window coverings are impractical or undesirable. Various colors and texture patterns provide translucent or semi-opaque effect. May be tempered for use where safety glass is required.

C. Reference Standards:
1. ASTM International:
c. ASTM E2112-19, 'Standard Practice for Installation of Exterior Windows, Doors and Skylights'.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
1. Participate in pre-installation conference.
2. Schedule conference before scheduled installation of vinyl windows.
3. In addition to agenda items specified in Section 01 3100, review following:
a. Review installation scheduling, coordination, and placement of windows.
b. Review Manufacturer's installation requirements to assure issuance of Manufacturer's warranty.
c. Before installing windows, review Manufacturer's submitted installation requirements and install first window, including flashing and sealant, to demonstrate standard for installation of remaining windows.

1.4 SUBMITTALS

A. Action Submittals:
1. Product Data:
a. Manufacturer's literature or cut sheet.
b. Literature on glazing.
c. Color selection.
d. Window U and SHGC Factors, written certificate from window manufacture.

2. Shop Drawings: Submit before beginning framing. Show rough opening requirements.

B. Informational Submittals:
   1. Manufacturer Instructions:
      a. Manufacturer's published installation instructions for windows, flashing, and sealants.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Warranty Documentation:
         1) Include copy of final, executed warranty.

1.5 QUALITY ASSURANCE

A. Certification:

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Materials shall be delivered in original, unopened packages with labels intact.
   2. Examine and report damaged materials to Architect and/or Owner immediately.

B. Storage And Handling Requirements:
   1. Provide secure location protected from the weather and other trades.
   2. Store window units in an upright position in clean and dry storage area above ground and protect from weather.

1.7 WARRANTY

A. Special Warranty:
   1. Provide written non-prorated Manufacturer's warranty including:
      a. Ten (10) years for glass, parts and labor.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Category Four Manufacturers. See Section 01 6200 for definitions of Categories:
   1. Montecito Window if available or Tuscany Window by Milgard Manufacturing Inc, Tacoma, WA www.milgard.com.
      a. Contact Information:
         2) Primary Contact: Jeff Mead, cell (801) 597-2664 jeffmead@milgard.com.
         3) Inside Sales, (800) 777-7714 Candice Willis, candicewilles@milgard.com.

B. Manufactured Window Units:
   1. Fixed Window:
      a. Montecito Picture:
C. Design Criteria:
   1. Performance:
      a. Comply with minimum test requirements of AAMA / WDMA / CSA 101 for classification of specified window in following:
         1) Air infiltration.
         2) Water Resistance.
         3) Wind Load Resistance.
         4) Condensation Resistance.
         5) Uniform structural load.
      b. AAMA / WDMA / CSA 101 classification C30 minimum for windows, tested at 4 feet wide by 7 feet high minimum.
      c. Meet following thermal performance:
         1) Condensation Resistance Factor (CRF) of 48 minimum when tested in accordance with AAMA 1503.
         2) Thermal Transmittance of 0.65 maximum when tested in accordance with AAMA 1503.
   D. Manufactured Units:
      1. Windows:
         a. Factory glazed.
         b. Weatherstripped.
         c. Flanged for installation in framed buildings; Non-flanged for installation in masonry buildings. Installation method shall not require drilling into frame.
         d. Approved Color:
            1) White.
         e. Muntin Pattern:
            1) Determined by building style selection.
   E. Fabrication:
      1. Corners shall be thermally fused.
   F. Glazing Requirements:
      1. Glazing Characteristics:
         a. Obscure interior pane with pattern on surface 3 and Clear exterior pane with Milgard SunCoatMax 366 Low-E treatment on surface 2.
         b. Windows into Foyers:
            1) Clear interior pane and Clear exterior pane with Milgard SunCoatMax 366 Low-E treatment on surface 2.
      2. Glazing Beads: Manufacturer's standard.

2.2 ACCESSORIES

A. Anchoring Devices:
   1. Aluminum or stainless steel.
   2. Other corrosion-resistant or insulated anchors as specifically approved by Architect in writing before use.

B. Flashing:
   2. Type Two Acceptable Products:
2.3 SOURCE QUALITY CONTROL

A. Identification:
   1. When delivered to Project site, windows shall bear permanent label stating model of window and Manufacturer's name, or AAMA label.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Evaluation And Assessment:
   1. Openings:
      a. Examine openings for adequacy in allowing successful installation and operation.
      b. Verify openings are prepared to specified dimensions and are plumb and level.
      a. Do not install windows until conditions have been corrected.
   3. Commencement of Work by installer is considered acceptance of substrate.

3.2 INSTALLATION

A. Set window frame plumb, level, and in alignment. Secure window properly in opening.

B. Apply specified sealant between window frame and building wall as specified in Section 07 9213.

C. Apply flashing.

3.3 FIELD QUALITY CONTROL

A. Field Inspections:
   1. After installation of windows and before installation of exterior wall finish, inspect windows and compare to installation standard accepted at Pre-Installation Conference.

B. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
   1. Correct any work found defective or not complying with contract document requirements at no additional cost to the Owner.

3.4 CLEANING

A. After installation, clean interior and exterior surfaces of windows and accessories of mortar, plaster, paint, and other contaminants. Maintain protection and provide final cleaning.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes: Finish Hardware for door openings, except as otherwise specified herein.
1. Door hardware for steel (hollow metal) doors.
2. Door hardware for aluminum doors.
3. Door hardware for wood doors.
4. Door hardware for other doors indicated.
5. Keyed cylinders as indicated.

B. Related Sections:
1. Division 6: Rough Carpentry.
2. Division 8: Aluminum Doors and Frames
3. Division 8: Hollow Metal Doors and Frames.
5. Division 26 Electrical
6. Division 28: Electronic Security

C. References: Comply with applicable requirements of the following standards. Where these standards conflict with other specific requirements, the most restrictive shall govern.
1. Builders Hardware Manufacturing Association (BHMA)
3. NFPA 80 -Fire Doors and Windows
4. ANSI-A156.xx- Various Performance Standards for Finish Hardware
5. UL10C – Positive Pressure Fire Test of Door Assemblies
6. ANSI-A117.1 – Accessible and Usable Buildings and Facilities
7. DHI /ANSI A115.1G – Installation Guide for Doors and Hardware

D. Intent of Hardware Groups
1. Should items of hardware be omitted or incorrectly specified, but are required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
2. Where items of are omitted or incorrectly specified, but are required for completion of the Work, a written statement of such omission, error, or other discrepancy to be submitted to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.

E. Allowances
1. Refer to Division 1 for allowance amount and procedures.

F. Alternates
1. Refer to Division 1 for Alternates and procedures.

1.2 SUBSTITUTIONS:

A. Comply with Division 1.
1.3 SUBMITTALS:

A. Comply with Division 1.

B. Special Submittal Requirements: Combine submittals of this Section with Sections listed below to ensure the "design intent" of the system/assembly is understood and can be reviewed together.

C. Product Data: Manufacturer's specifications and technical data including the following:
   1. Detailed specification of construction and fabrication.
   2. Manufacturer's installation instructions.
   3. Wiring diagrams for each electric product specified. Coordinate voltage with electrical before submitting.
   4. Submit 6 copies of catalog cuts with hardware schedule.
   5. Provide 9001-Quality Management and 14001-Environmental Management for products listed in Materials Section 2.2

D. Shop Drawings - Hardware Schedule: Submit 6 complete reproducible copy of detailed hardware schedule in a vertical format.
   1. List groups and suffixes in proper sequence.
   2. Completely describe door and list architectural door number.
   3. Manufacturer, product name, and catalog number.
   4. Function, type, and style.
   5. Size and finish of each item.
   7. Explanation of abbreviations and symbols used within schedule.
   8. Detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment and access control equipment, and door and frame rough-ins required for specific opening.

E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.
   1. Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.

F. Samples: (If requested by the Architect)
   1. 1 sample of Lever and Rose/Escutcheon design, (pair).
   2. 3 samples of metal finishes

G. Contract Closeout Submittals: Comply with Division 1 including specific requirements indicated.
   1. Operating and maintenance manuals: Submit 3 sets containing the following.
      a. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
      b. Catalog pages for each product.
      c. Name, address, and phone number of local representative for each manufacturer.
      d. Parts list for each product.
   2. Copy of final hardware schedule, edited to reflect, "As installed".
   3. Copy of final keying schedule
   4. As installed "Wiring Diagrams" for each piece of hardware connected to power, both low voltage and 110 volts.
   5. One set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.4 QUALITY ASSURANCE

A. Comply with Division 1.
   1. Statement of qualification for distributor and installers.
2. Statement of compliance with regulatory requirements and single source responsibility.
3. Distributor's Qualifications: Firm with 3 years’ experience in the distribution of commercial hardware.
   a. Distributor to employ full time Architectural Hardware Consultants (AHC) for the purpose of scheduling and coordinating hardware and establishing keying schedule.
   b. Hardware Schedule shall be prepared and signed by an AHC.
4. Installer's Qualifications: Firm with 3 years experienced in installation of similar hardware to that required for this Project, including specific requirements indicated.
5. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.
   a. Provide UL listed hardware for labeled and 20-minute openings in conformance with requirements for class of opening scheduled.
   b. Underwriters Laboratories requirements have precedence over this specification where conflict exists.
6. Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.

B. Review Project for extent of finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware, notify the Architect in writing and furnish hardware in compliance with the Specification unless otherwise directed in writing by the Architect.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Comply with Division 1.
   1. Deliver products in original unopened packaging with legible manufacturer's identification.
   2. Package hardware to prevent damage during transit and storage.
   3. Mark hardware to correspond with "reviewed hardware schedule".
   4. Deliver hardware to door and frame manufacturer upon request.

B. Storage and Protection: Comply with manufacturer's recommendations.

1.6 PROJECT CONDITIONS:

A. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.

B. Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.7 WARRANTY:

A. Refer to Conditions of the Contract

B. Manufacturer’s Warranty:
   1. Closers: Ten years
   2. Exit Devices: Five Years
   3. Locksets & Cylinders: Three years
   4. All other Hardware: Two years.

1.8 OWNER’S INSTRUCTION:

A. Instruct Owner’s personnel in operation and maintenance of hardware units.
1.9 MAINTENANCE:

A. Extra Service Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals Section.
   1. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
   2. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.
   3. Delivery, Storage and Protection: Comply with Owner’s requirements for delivery, storage and protection of extra service materials.

B. Maintenance Service: Submit for Owner’s consideration maintenance service agreement for electronic products installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. The following manufacturers are approved subject to compliance with requirements of the Contract Documents. Approval of manufacturers other than those listed shall be in accordance with Division 1.

<table>
<thead>
<tr>
<th>Item</th>
<th>Manufacturer</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinges</td>
<td>Stanley Bommer, Hager</td>
<td></td>
</tr>
<tr>
<td>Continuous Hinges</td>
<td>Stanley Select, ABH</td>
<td></td>
</tr>
<tr>
<td>Locksets</td>
<td>Stanley Commercial</td>
<td>Yale, Falcon</td>
</tr>
<tr>
<td>Cylinders</td>
<td>Schlage</td>
<td>No Substitutions</td>
</tr>
<tr>
<td>Exit Devices</td>
<td>Stanley Commercial</td>
<td>Yale, Dtex</td>
</tr>
<tr>
<td>Closers</td>
<td>Stanley QDC100</td>
<td>Falcon, Hager</td>
</tr>
<tr>
<td>Push/Pull Plates</td>
<td>Trimco</td>
<td>Burns, Rockwood</td>
</tr>
<tr>
<td>Push/Pull Bars</td>
<td>Trimco</td>
<td>Burns, Rockwood</td>
</tr>
<tr>
<td>Protection Plates</td>
<td>Trimco</td>
<td>Burns, Rockwood</td>
</tr>
<tr>
<td>Overhead Stops</td>
<td>ABH</td>
<td>Rixson, Glynn Johnson</td>
</tr>
<tr>
<td>Door Stops</td>
<td>Trimco</td>
<td>Burns, Rockwood</td>
</tr>
<tr>
<td>Flush Bolts</td>
<td>Trimco</td>
<td>ABH, Burns</td>
</tr>
<tr>
<td>Coordinator &amp; Brackets</td>
<td>Trimco</td>
<td>ABH, Burns</td>
</tr>
<tr>
<td>Threshold &amp; Gasketing</td>
<td>National Guard</td>
<td>Reese, K.N. Crowder</td>
</tr>
</tbody>
</table>

2.2 MATERIALS:

A. Hinges: Shall be Five Knuckle Ball bearing hinges
   1. Template screw hole locations
   2. Bearings are to be fully hardened.
   3. Bearing shell is to be consistent shape with barrel.
   4. Minimum of 2 permanently lubricated non-detachable bearings on standard weight hinge and 4 permanently lubricated bearing on heavy weight hinges.
   5. Equip with easily seated, non-rising pins.
   6. Non-Removable Pin screws shall be slotted stainless steel screws.
   7. Hinges shall be full polished, front, back and barrel.
   8. Hinge pin is to be fully plated.
   9. Bearing assembly is to be installed after plating.
   10. Sufficient size to allow 180-degree swing of door
   11. Furnish five knuckles with flush ball bearings
12. Provide hinge type as listed in schedule.
13. Furnish 3 hinges per leaf to 7-foot 6-inch height. Add one for each additional 30 inches in height or fraction thereof.
14. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish
15. UL10C listed for Fire rated doors.

B. Geared Continuous Hinges:
1. Tested and approved by BHMA for ANSI A156.26-1996 Grade 1
2. Anti-spinning through fastener
3. UL10C listed for 3-hour Fire rating
4. Non-handed
5. Lifetime warranty
6. Provide Fire Pins for 3-hour fire ratings
7. Sufficient size to permit door to swing 180 degrees

C. Cylindrical Grade 2 Type Locks and Latchsets:
1. Certified by BHMA for ANSI A156.3, Series 4000, Operational Grade 2.
2. Fit modified ANSI A115.3 door preparation
3. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty
4. 2-3/4-inch (70mm) backset, or 2 3/8-inch backset as needed
5. 1/2-inch (14mm) throw latchbolt
6. Provide locksets with 7-pin core.
7. Functions and design as indicated in the hardware groups

D. Cylindrical Deadbolt:
1. Tested and approved by ANSI A156.36, Operational Grade 1,
2. Fit modified ANSI A115.3 door preparation
4. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty
5. 2-3/4-inch (70mm) backset, or 2 3/8-inch backset as needed
6. 1-inch throw deadbolt
7. Provide locksets with 7-pin core.

E. Exit Devices shall:
1. Tested and approved by BHMA for ANSI 156.3, Grade 1
3. Furnish UL or recognized independent laboratory certified mechanical operational testing to 10 million cycles minimum.
4. Provide a deadlocking latchbolt
5. Non-fire rated exit devices shall have cylinder dogging.
6. Touchpad shall be “T” style
7. Exposed components shall be of architectural metals and finishes.
8. Lever design shall match lockset lever design
9. Provide strikes as required by application.
10. Fire exit devices to be listed for UL10C
11. UL listed for Accident Hazard
12. Shall consist of a cross bar or push pad, the actuating portion of which extends across, shall not be less than one half the width of the door leaf.
13. Provide vandal resistant or breakaway trim
14. Aluminum vertical rod assemblies are acceptable only when provide with the manufacturers optional top and bottom stainless steel rod guard protectors.

F. Cylinders:
1. Provide the necessary cylinder housings, collars, rings & springs as recommended by the manufacturer for proper installation.
2. Provide the proper cylinder cams or tail piece as required to operate all locksets and other keyed hardware items listed in the hardware sets.
3. Coordinate and provide as required for related sections
4. Provide Schlage 7-pin cylinders in keyway and configuration as directed by the Owner/Architect.

G. Door Closers shall:
   1. Tested and approved by BHMA for ANSI 156.4, Grade 1
   2. UL10C certified
   4. Closer shall have extra-duty arms and knuckles
   5. Conform to ANSI 117.1
   6. Maximum 2-7/16-inch case projection with non-ferrous cover
   7. Separate adjusting valves for closing and latching speed, and backcheck
   8. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
   9. Full rack and pinion type closer with 1-1/2-inch minimum bore
   10. Mount closers on non-public side of door, unless otherwise noted in specification
   11. Closers shall be non-handed, non-sized and multi-sized.

H. Door Stops: Provide a dome floor or wall stop for every opening as listed in the hardware sets.
   1. Wall and floor stops shall be wrought bronze, brass or stainless steel.
   2. Provide fastener suitable for wall construction.
   3. Coordinate reinforcement of walls where wall stop is specified.
   4. Provide dome stops where wall stops are not practical. Provide spacers or carpet riser for floor conditions encountered

I. Over Head Stops: Provide a Surface mounted or concealed overhead when a floor or wall stop cannot be used or when listed in the hardware set.
   1. Concealed overhead stops shall be heavy duty bronze or stainless steel.
   2. Surface overhead stops shall be heavy duty bronze or stainless steel.

J. Push Plates: Provide with four beveled edges ANSI J301, .050 thickness, size as indicated in hardware set. Furnish oval-head countersunk screws to match finish.

K. Pulls with plates: Provide with four beveled edges ANSI J301, .050 thickness Plate s with ANSI J401 Pull as listed in hardware set. Provide proper fasteners for door construction.

L. Push Pull Bars: Provide ANSI J504, .1” Dia. Pull and push bar model and series as listed in hardware set. Provide proper fasteners for door construction.

M. Kickplates: Provide with four beveled edges ANSI J102, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.

N. Mop plates: Provide with four beveled edges ANSI J103, 4 inches high by width less 1 inch on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.

O. Door Bolts: Flush bolts for wood or metal doors.
   1. Provide a set of Automatic bolts, Certified ANSI/BHMA 156.3 Type 25 for hollow metal label doors.
   2. Provide a set of Automatic bolts, Certified ANSI/BHMA 156.3 Type 27 at wood label doors.
   3. Manual flush bolts, Certified ANSI/BHMA 156.16 at openings where allowed local authority.
   4. Provide Dust Proof Strike, Certified ANSI/BHMA 156.16 at doors with flush bolts without thresholds.

P. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.
Q. Provide one wall mounted Telkee, Lund or MMF series key cabinet complete with hooks, index and tags to accommodate 50% expansion. Coordinate mounting location with architect.

R. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.

2.3 FINISH:

A. Designations used in Schedule of Finish Hardware - 3.05, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products

B. Powder coat door closers to match other hardware, unless otherwise noted.

C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.4 KEYS AND KEYING:

A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.

B. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.

C. Keying Schedule: Arrange for a keying meeting, and programming meeting with Architect Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with project requirements. Furnish 3 typed copies of keying and programming schedule to Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.
   1. Do not proceed until unsatisfactory conditions have been corrected.

3.2 HARDWARE LOCATIONS:

A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.
   1. Recommended Locations for Builder’s Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).
   2. Recommended locations for Architectural Hardware for flush wood doors (DHI).
3.3 INSTALLATION:

A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

B. Conform to local governing agency security ordinance.

C. Install Conforming to ICC/ANSI A117.1 Accessible and Usable Building and Facilities.
   1. Adjust door closer sweep periods so that from the open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the landing side of the door.

D. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use “Riv-Nuts” or similar products.

3.4 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

A. Contractor/Installers, Field Services: After installation is complete, contractor shall inspect the completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.
   1. Check and adjust closers to ensure proper operation.
   2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.
      a. Verify levers are free from binding.
      b. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.
   3. Report findings, in writing, to architect indicating that all hardware is installed and functioning properly. Include recommendations outlining corrective actions for improperly functioning hardware if required.

3.5 SCHEDULE OF FINISH HARDWARE:

<table>
<thead>
<tr>
<th>Manufacturer List</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
</tr>
<tr>
<td>AB</td>
</tr>
<tr>
<td>NA</td>
</tr>
<tr>
<td>SC</td>
</tr>
<tr>
<td>SH</td>
</tr>
<tr>
<td>ST</td>
</tr>
<tr>
<td>TR</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Option List</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
</tr>
<tr>
<td>SN</td>
</tr>
<tr>
<td>CSK</td>
</tr>
<tr>
<td>B4E-HEAVY-KP</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Finish List</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
</tr>
<tr>
<td>AL</td>
</tr>
<tr>
<td>626</td>
</tr>
<tr>
<td>630</td>
</tr>
<tr>
<td>689</td>
</tr>
<tr>
<td>GREY</td>
</tr>
<tr>
<td>US26D</td>
</tr>
<tr>
<td>US32D</td>
</tr>
</tbody>
</table>
## Hardware Sets

### SET #01 -

Doors: 100A, 108A

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
<th>Finish</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Continuous Geared Hinges</td>
<td>661HD UL 83&quot;</td>
<td>AL</td>
<td>ST</td>
</tr>
<tr>
<td>2 Exit Devices</td>
<td>QED225</td>
<td>626</td>
<td>SH</td>
</tr>
<tr>
<td>2 Mortise Cylinders</td>
<td>as Requested by Owner</td>
<td>626</td>
<td>SC</td>
</tr>
<tr>
<td>1 Rim Cylinder</td>
<td>as Requested by Owner</td>
<td>626</td>
<td>SC</td>
</tr>
<tr>
<td>2 Offset Door Pulls</td>
<td>1191-5</td>
<td>630</td>
<td>TR</td>
</tr>
<tr>
<td>2 EDA Door Closers</td>
<td>QDC115 SN</td>
<td>689</td>
<td>SH</td>
</tr>
<tr>
<td>2 Inst. Door Stops w/ Holders</td>
<td>1209HO</td>
<td>630</td>
<td>TR</td>
</tr>
<tr>
<td>2 Drop Plates</td>
<td>8Q00471</td>
<td>689</td>
<td>SH</td>
</tr>
</tbody>
</table>

**NOTE:** Balance of Hardware by Aluminum Door/Frame supplier/Manufacturer. Mount Door Stops well clear of foot traffic.

### SET #02 -

Doors: 100B

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
<th>Finish</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Hinges</td>
<td>FBB179 4 1/2 X 4 1/2</td>
<td>US26D</td>
<td>ST</td>
</tr>
<tr>
<td>2 Push/Pull Bar Sets</td>
<td>1747 32&quot;</td>
<td>630</td>
<td>TR</td>
</tr>
<tr>
<td>2 EDA Door Closers</td>
<td>QDC115 SN</td>
<td>689</td>
<td>SH</td>
</tr>
<tr>
<td>2 Kick Plates</td>
<td>K0050 8&quot; x 34&quot; B4E-HEAVY-KP CSK</td>
<td>630</td>
<td>TR</td>
</tr>
<tr>
<td>2 Door Stops/ Holders</td>
<td>1260W</td>
<td>626</td>
<td>TR</td>
</tr>
<tr>
<td>1 Set of Gasketing</td>
<td>5050 B-20 20'</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>1 Astragal Set</td>
<td>9115 A SET 84&quot;</td>
<td>NA</td>
<td></td>
</tr>
</tbody>
</table>

### SET #03 -

Doors: 102, 106

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
<th>Finish</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Hinges</td>
<td>FBB179 4 1/2 X 4 1/2</td>
<td>US26D</td>
<td>ST</td>
</tr>
<tr>
<td>1 Pull Plate</td>
<td>1018-3B</td>
<td>630</td>
<td>TR</td>
</tr>
<tr>
<td>1 Door Closer</td>
<td>QDC111 SN</td>
<td>689</td>
<td>SH</td>
</tr>
<tr>
<td>1 Kick Plate</td>
<td>K0050 8&quot; x 34&quot; B4E-HEAVY-KP CSK</td>
<td>630</td>
<td>TR</td>
</tr>
<tr>
<td>1 Push Plate</td>
<td>1001-11</td>
<td>630</td>
<td>TR</td>
</tr>
<tr>
<td>1 Mop Plate</td>
<td>KM050 4&quot; x 35&quot; B4E-HEAVY-KP CSK</td>
<td>630</td>
<td>TR</td>
</tr>
<tr>
<td>1 Wall Stop</td>
<td>1270WV</td>
<td>630</td>
<td>TR</td>
</tr>
</tbody>
</table>

### SET #04 -

Doors: 103, 109, 111

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
<th>Finish</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Hinges</td>
<td>FBB179 4 1/2 X 4 1/2</td>
<td>US26D</td>
<td>ST</td>
</tr>
<tr>
<td>1 Privacy Lock</td>
<td>QCL140 M</td>
<td>626</td>
<td>SH</td>
</tr>
<tr>
<td>1 Wall Stop</td>
<td>1270WV</td>
<td>630</td>
<td>TR</td>
</tr>
<tr>
<td>1 Set of Gasketing</td>
<td>5050 B-20 20'</td>
<td>NA</td>
<td></td>
</tr>
</tbody>
</table>
The Church of Jesus Christ of Latter-day Saints  
Garden City Assembly Hall

**SET #05 -**

Doors: 104

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Part Number</th>
<th>Finish</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Hinges</td>
<td>FBB179 4 1/2 X 4 1/2 NRP</td>
<td>US26D</td>
<td>ST</td>
</tr>
<tr>
<td>1 Classroom Deadbolt</td>
<td>QDB286</td>
<td>626</td>
<td>SH</td>
</tr>
<tr>
<td>1 Pull Plate</td>
<td>1018-3B</td>
<td>630</td>
<td>TR</td>
</tr>
<tr>
<td>1 EDA Door Closers</td>
<td>QDC115 SN</td>
<td>689</td>
<td>SH</td>
</tr>
<tr>
<td>1 Kick Plate</td>
<td>K0050 8&quot; x 34&quot; B4E-HEAVY-KP CSK</td>
<td>630</td>
<td>TR</td>
</tr>
<tr>
<td>1 Push Plate</td>
<td>1001-11</td>
<td>630</td>
<td>TR</td>
</tr>
<tr>
<td>1 Mop Plate</td>
<td>KM050 4&quot; x 35&quot; B4E-HEAVY-KP CSK</td>
<td>630</td>
<td>TR</td>
</tr>
</tbody>
</table>

NOTE: Provide the Deadbolt with Schlage core, as directed by Owner/Architect.

**SET #06 -**

Doors: 105, 113

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Part Number</th>
<th>Finish</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Hinges</td>
<td>FBB179 4 1/2 X 4 1/2 NRP</td>
<td>US26D</td>
<td>ST</td>
</tr>
<tr>
<td>1 Storeroom Lock</td>
<td>QCL270 M</td>
<td>626</td>
<td>SH</td>
</tr>
<tr>
<td>1 Overhead Stop</td>
<td>4424</td>
<td>US32D</td>
<td>AB</td>
</tr>
<tr>
<td>1 Coat Hook</td>
<td>3071-1</td>
<td>630</td>
<td>TR</td>
</tr>
<tr>
<td>3 Door Silencers</td>
<td>1229A</td>
<td>GREY</td>
<td>TR</td>
</tr>
</tbody>
</table>

NOTE: Provide the lockset with Schlage keyway as directed by Owner/Architect.

**SET #07 -**

Doors: 107

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Part Number</th>
<th>Finish</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Hinges</td>
<td>FBB179 4 1/2 X 4 1/2 NRP</td>
<td>US26D</td>
<td>ST</td>
</tr>
<tr>
<td>2 Flush Bolts</td>
<td>3917-12</td>
<td>626</td>
<td>TR</td>
</tr>
<tr>
<td>1 Storeroom Lock</td>
<td>QCL270 M</td>
<td>626</td>
<td>SH</td>
</tr>
<tr>
<td>2 Wall Stops</td>
<td>1270WV</td>
<td>630</td>
<td>TR</td>
</tr>
<tr>
<td>1 Dustproof Strike</td>
<td>3910</td>
<td>630</td>
<td>TR</td>
</tr>
<tr>
<td>2 Door Silencers</td>
<td>1229A</td>
<td>GREY</td>
<td>TR</td>
</tr>
</tbody>
</table>

NOTE: Provide the lockset with Schlage keyway as directed by Owner/Architect.

**SET #08 -**

Doors: 108B

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Part Number</th>
<th>Finish</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Hinges</td>
<td>FBB179 4 1/2 X 4 1/2</td>
<td>US26D</td>
<td>ST</td>
</tr>
<tr>
<td>2 Push/Pull Bar Sets</td>
<td>1747 32&quot;</td>
<td>630</td>
<td>TR</td>
</tr>
<tr>
<td>2 EDA Door Closers</td>
<td>QDC115 SN</td>
<td>689</td>
<td>SH</td>
</tr>
<tr>
<td>2 Door Stops/holders</td>
<td>1260W</td>
<td>626</td>
<td>TR</td>
</tr>
</tbody>
</table>

NOTE: Balance of Hardware by Aluminum Door/Frame Supplier.
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

SET #09 -

Doors: 110A

2 Continuous Geared Hinges 661HD UL 83" AL ST
2 Exit Devices QED225 626 SH
2 Mortise Cylinders as Requested by Owner 626 SC
1 Rim Cylinder as Requested by Owner 626 SC
2 Offset Door Pulls 1191-5 630 TR
1 EDA Door Closer QDC115 SN 689 SH
1 Low Energy Operator ED 900 J8 FWS 689 DM
2 Inst. Door Stops w/ Holders 1209HO 630 TR
3 Wall Switches WS 1 SQ4 630 DM
2 Drop Plates 8Q00471 689 SH

NOTE: Doors must be dogged for automatic operation.

SET #10 -

Doors: 110B

6 Hinges FBB179 4 1/2 X 4 1/2 US26D ST
2 Push/Pull Bar Sets 1747 32" 630 TR
1 EDA Door Closer QDC115 SN 689 SH
1 Low Energy Operator ED 900 T FWS 689 DM
2 Door Stops/Holders 1260W 626 TR

NOTE: Balance of Hardware by Aluminum Door/Frame Supplier/Manufacturer.

SET #11 -

Doors: 112

3 Hinges FBB179 4 1/2 X 4 1/2 US26D ST
1 Storeroom Lock QCL270 M 626 SH
1 Wall Stop 1270WV 630 TR
3 Door Silencers 1229A GREY TR

NOTE: Provide the lockset with Schlage keyway as directed by Owner/Architect.
Opening List

<table>
<thead>
<tr>
<th>Opening</th>
<th>Hdw Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>100A</td>
<td>01</td>
</tr>
<tr>
<td>100B</td>
<td>02</td>
</tr>
<tr>
<td>102</td>
<td>03</td>
</tr>
<tr>
<td>103</td>
<td>04</td>
</tr>
<tr>
<td>104</td>
<td>05</td>
</tr>
<tr>
<td>105</td>
<td>06</td>
</tr>
<tr>
<td>106</td>
<td>03</td>
</tr>
<tr>
<td>107</td>
<td>07</td>
</tr>
<tr>
<td>108A</td>
<td>01</td>
</tr>
<tr>
<td>108B</td>
<td>08</td>
</tr>
<tr>
<td>109</td>
<td>04</td>
</tr>
<tr>
<td>110A</td>
<td>09</td>
</tr>
<tr>
<td>110B</td>
<td>10</td>
</tr>
<tr>
<td>111</td>
<td>04</td>
</tr>
<tr>
<td>112</td>
<td>11</td>
</tr>
<tr>
<td>113</td>
<td>06</td>
</tr>
</tbody>
</table>
SECTION 08 8100
GLASS GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Quality of glazing used in entries, doors, and windows.

B. Related Requirements:
   1. Sections Under 08 1000 Heading: 'Doors And Frames' for furnishing and installing of flush wood door lites in new doors.
   2. Section 08 4113: 'Aluminum-Framed Entrances And Storefronts' for furnishing and installing of glazing in aluminum-framed storefront.
   3. Section 08 5113: Vinyl Windows for furnishing and installing of glazing in windows.

1.2 REFERENCES

A. Definitions:
   1. Glass Surface:
a. Insulated glass unit:
   1) Surface 1: Exterior surface of outer lite.
   2) Surface 2: Interspace-facing surface of outer lite.
   3) Surface 3: Interspace-facing surface of inner lite.
   4) Surface 4: Interior surface of inner lite.

b. Monolithic glass:
   1) Surface 1: Exterior surface.
   2) Surface 2: Interior surface.

2. Insulated Glass: Two pieces of glass spaced apart and hermetically sealed to form single-glazed unit with air space between. Heat transmission through this type of glass may be as low as half that without air space. Also called double glazing, double pane, insulated unit, and thermal pane.

3. Laminated Glass: Two or more sheets with inner layer of transparent plastic to which glass adheres if broken. Used for overhead, safety glazing, and sound reduction.

4. Low-Emissivity Glass (Low-E): Reduces wintertime heat loss from interior with thin, almost colorless metallic coating that reflects heat back inside structure. Allows moderate solar heat gain while reducing harmful ultraviolet light in any season. Minimizes summertime air conditioning loss by reflecting radiated heat to outside. May be tempered for where safety glass is required. Available in single strength clear, gray and bronze (brown) color.

5. Obscure Glass: Adds privacy where window coverings are impractical or undesirable. Various colors and texture patterns provide translucent or semi-opaque effect. May be tempered for use where safety glass is required.

6. Shading Coefficient: Ratio of solar heat gain passing through a glazing system to solar heat gain that occurs under the same conditions if the window was made of clear, unshaded double strength glass. Lower SC number, the better solar control efficiency of glazing system.

7. Solar Heat Gain Coefficient (SHGC): Ratio of total solar heat passing through a given window relative to the solar heat incident on the projected window surface at normal solar incidence. (Percentage of solar energy directly transmitted or absorbed and re-radiated into a building). Lower SHGC, the better it is able to reduce heat.

8. Solar Reflectance (R): Percent of incident solar radiation that is reflected by window film/glass system. Lower the number, the less solar radiation reflected.

9. Tempered Glass: Glass strengthened through process of heating, creating tensile strength that causes glass to resist breakage, yet disintegrate into small pieces if break occurs. Tempered glass is type of safety glass.


11. Visible Light Transmitted (VLT): Percent of total visible light (380-780 nanometers) that passes through glass. Lower the number, the less visible light transmitted.

B. Reference Standards:
   1. American National Standards Institute:
   2. ASTM International:
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer’s data sheets for each glass product and glazing material.

B. Informational Submittals:
   1. Qualification Statement:
      a. Installer:
         1) Provide Qualification documentation if requested by Architect or Owner.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Warranty Documentation:
         1) Final, executed copy of Warranty.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   2. Comply with published recommendations of glass product Manufacturers and organizations, except where more stringent requirements are indicated.

B. Qualifications:
   1. Installer: Requirements of Section 01 4301 applies, but not limited to following:
      a. Satisfactorily completed at least three (3) installations of similar size, scope, and complexity in each of past two (2) years and be approved by glass product Manufacturer before bidding.
      b. Upon request, submit documentation.

C. Certifications:
   1. Labels showing strength, grade, thickness, type, and quality are required on each piece of glass.
   2. Manufacturers/Fabricators certifying products furnished comply with project requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Follow Manufacturer’s instruction for receiving, handling, and protecting glass & glazing materials to prevent breakage scratching, damage to seals, or other visible damage.
   2. Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

B. Storage And Handling Requirements:
   1. Follow Manufacturer’s instruction for storing and protecting glass & glazing materials.
   2. Store materials protected from exposure to harmful environmental conditions and at temperatures and humidity conditions recommended by Manufacturer.
   3. Protect edge damage to glass, and damage/deterioration to coating on glass.

1.6 FIELD CONDITIONS

A. Ambient Conditions:
1. Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing material manufacturer or when joint substrates are wet due to rain, frost, condensation or other causes.

1.7 WARRANTY

A. Manufacturer Warranty:
   1. Insulating Glass Warranty:
      a. Manufacturer's standard form, signed by insulating-glass product Manufacturer/Fabricator, agreeing to replace insulating-glass units that exhibit failure of hermetic seal under normal use evidenced by obstruction of vision by dust, moisture, or film on interior surfaces of glass, for ten [10] years of date of installation.
   2. Installer’s Warranty:
      a. Form acceptable to Owner, signed by glass product Installer, agreeing to replace glass products that deteriorate, or that exhibit damage or deterioration of glass or glazing products due to faulty installation, for two (2) years from date of installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers:
   1. Manufacturer Contact List for Low E Glazing:
      f. Vitro Architectural Glass (formerly PPG glass), Cheswick, PA www.ppgglass.com or PPG Canada Ltd, Glass Division, Toronto, ON (416) 789-3331.

B. Design Criteria:
   1. Glazing for Fire-Rated Door and Window Assemblies: Glazing tested per NFPA 252 and NFPA 257, as applicable, for assemblies complying with NFPA 80 and listed and labeled per requirements of authorities having jurisdiction.

C. Exterior Window Glazing:
   1. Thickness: 1/8 inch (3 mm) minimum, Double Strength (Insulated Glass).
   2. Glazing shall have following characteristics:
      a. Low-Emissivity (or Low E):
         1) Design Criteria:
            a) Clear:
            b) Meet requirements of ASTM C1036, Type I, Class I, Quality Q3.
            c) Location: Surface 2.
         2) Type Two Low-Emissivity (or Low E) Acceptable Product:
            a) Performance Standard:
               (1) 70 percent Visible Light Transmission (VLT).
               (2) 0.29 U-value winter.
               (3) 0.27 U-value summer.
               (4) 0.38 Solar Heat Gain Coefficient (SHGC).
               (5) 0.44 Shading Coefficient.
               (6) 11 percent Visible Light Reflectance.
            b) Quality Standard:
               (1) Cardinal LoE³-366.
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

218036 Garden City Assembly Hall
08 8100 - 5

GLAZING

(2) Solarban 70 XL.
(3) Other low E glazing system standard with window manufacturer that meets or exceeds performance characteristics of specified glazing is acceptable as approved by Architect before bidding. See Section 01 6200.

3) Acceptable Manufacturers:
   a) AGC.
   b) Guardian.
   c) Vitro Architectural Glass.
   d) Equal as approved by Architect before bidding. See Section 01 6200.

b. Obscure:
   1) Design Criteria:
      a) Meet requirements of ASTM C1036, Type II, Class I, Form 3, Quality Q8, Pattern #62.

c. Glazing in Windows within 24 inches (600 mm) of Exterior Doors:
   1) Design Criteria:
      a) Tempered.
      b) Meet requirements of ASTM C1048, Kind FT, Condition A, Type I, Class I, Quality Q3.

D. Storefront Glazing:
1. Thickness: 1/4 inch (6 mm).
2. Glazing shall have following characteristics:
   a. Low-Emissivity (or Low E):
      1) Design Criteria:
         a) Clear.
         b) Insulated Glass: 1 inch (25 mm) units with 1/2 inch (13 mm) airspace and two (2) 1/4 inch (6 mm) lites.
         c) Meet requirements of ASTM C1036, Type I, Class I, Quality Q3.
         d) Location: Surface 2.
      2) Type Two Low-Emissivity (or Low E) Acceptable Product:
         a) Performance Standard:
            (1) 64 percent Visible Light Transmission (VLT).
            (2) 0.28 U-value winter.
            (3) 0.26 U-value summer.
            (4) 0.27 Solar Heat Gain Coefficient (SHGC).
            (5) 0.32 Shading Coefficient.
            (6) 12 percent Visible Light Reflectance.
         b) Quality Standard:
            (1) Cardinal LoE³-366.
            (2) Solarban 70 XL.
            (3) Equal product by Acceptable Manufacturer as approved by Architect before bidding. See Section 01 6200.
      3) Acceptable Manufacturers:
         a) AGC.
         b) Guardian.
         c) Vitro Architectural Glass.
         d) Equal as approved by Architect before bidding. See Section 01 6200.
   b. Obscure:
      1) Design Criteria:
         a) Meet requirements of ASTM C1036, Type II, Class I, Form 3, Quality Q8, Pattern #62.

c. Glazing Below Door Height:
   1) Design Criteria:
      a) Tempered.
      b) Meet requirements of ASTM C1048, Kind FT, Condition A, Type I, Class I, Quality Q3.

E. Fabrication:
1. Except where glass exceeds 66 inches \((1675 \text{ mm})\) in width, cut clear glass so any wave will run horizontally when glazed.

2. Install muntins for exterior aluminum entries and aluminum windows between panes of insulating glazing units. No muntins on interior Vestibule storefront entries.

3. Sealed, Insulating Glazing Units:
   a. Double pane, sealed insulating glass units. Install at exterior windows and exterior aluminum-framed storefront.
   b. Unit Thickness: 5/8 inch \((16 \text{ mm})\) minimum, 1 inch \((25 \text{ mm})\) maximum.
   c. Insulated obscure units shall consist of one pane of specified obscure glass and one pane of standard glass.
   d. Type Seal:
      1) Metal-to-glass bond and separated by 1/2 inch \((12.7 \text{ mm})\) dehydrated air space.
      2) Use non-hardening sealants.
   e. Category Four Approved Fabricators. See Section 01 6200 for definitions of Categories.
      1) Members of Sealed Insulating Glass Manufacturer's Association.

2.2 ACCESSORIES

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Glazing Tape: Butyl-based elastomeric tape with integral resilient tube spacer, 10 to 15 Shore A durometer hardness, black color, coiled on release paper; widths required for specified installation, complying with ASTM C1281 and AAMA 800 for application.

PART 3 - EXECUTION: Not Used

END OF SECTION
DIVISION 09 -- FINISHES

09 2116 - Gypsum Board Assemblies
09 3000 - Tiling
09 6500 - Resilient Flooring
09 9113 - Exterior Painting
09 9123 - Interior Painting
SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1  GENERAL
1.01  SECTION INCLUDES
A. Metal stud wall framing.
B. Metal channel ceiling framing.
C. Acoustic insulation.
D. Gypsum wallboard.
E. Joint treatment and accessories.

1.02  REFERENCE STANDARDS
F. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.
G. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2016.

PART 2  PRODUCTS
2.01  GYPSUM BOARD ASSEMBLIES
A. Provide completed assemblies complying with ASTM C840 and GA-216.

2.02  METAL FRAMING MATERIALS
A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf (L/120 at 240 Pa).
B. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

2.03  BOARD MATERIALS
A. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Thickness:
      a. Vertical Surfaces: 5/8 inch (16 mm).
      b. Ceilings: 5/8 inch (16 mm).
B. Abuse Resistant Wallboard:
   1. Application: Lower 4 feet of Chapel area only.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. Type: Fire resistance rated Type X, UL or WH listed.
   4. Thickness: 5/8 inch (16 mm).
   5. Edges: Tapered.

2.04 ACCESSORIES
A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 5.5 inch (139.7 mm).
B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
C. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel, unless noted otherwise.
D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
E. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
F. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.
G. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion resistant.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION
A. Metal Framing: Install in accordance with ASTM C754 and manufacturer’s instructions.
B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
C. Studs: Space studs at 16 inches on center (at 406 mm on center).
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer’s instructions.

3.03 ACOUSTIC ACCESSORIES INSTALLATION
A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
B. Acoustic Sealant: Install in accordance with manufacturer’s instructions.

3.04 BOARD INSTALLATION
A. Comply with ASTM C840, GA-216, and manufacturer’s instructions. Install to minimize butt end joints, especially in highly visible locations.
B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

3.05 INSTALLATION OF TRIM AND ACCESSORIES
A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
B. Corner Beads: Install at external corners, using longest practical lengths.
C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.
3.06 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas
      specifically indicated.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to
   receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).

C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface
   after joints have been properly treated; achieve a flat and tool mark-free finish.

END OF SECTION
SECTION 09 3000
TILING

PART 1  GENERAL

1.01  SECTION INCLUDES

A.  Tile for floor applications.

B.  Cementitious backer board as tile substrate.

1.02  REFERENCE STANDARDS


D.  ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).


1.03  SUBMITTALS

A.  Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

1.04  DELIVERY, STORAGE, AND HANDLING

A.  Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.05  FIELD CONDITIONS

A.  Do not install solvent-based products in an unventilated environment.

B.  Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during installation of mortar materials.
PART 2 PRODUCTS

2.01 TILE
A. Manufacturers: All products by the same manufacturer.

2.02 SETTING MATERIALS
A. Manufacturers:
   1. ARDEX Engineered Cements; _____: www.ardexamericas.com/#sle.

2.03 GROUTS
A. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
   1. Applications: All tile locations.
   2. Color(s): As selected by Architect from manufacturer's full line.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

3.02 PREPARATION
A. Protect surrounding work from damage.
B. Vacuum clean surfaces and damp clean.
C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

3.03 INSTALLATION - GENERAL
A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
E. Form internal angles square and external angles bullnosed.
F. Sound tile after setting. Replace hollow sounding units.
G. Keep control and expansion joints free of mortar, grout, and adhesive.
H. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
I. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
J. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - MORTAR BED METHODS
A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F111, with cleavage membrane, unless otherwise indicated.
   1. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with TCNA (HB) Method F114, with cleavage membrane.
B. Cleavage Membrane: Lap edges and ends.
C. Mortar Bed Thickness: 5/8 inch (15.9 mm), unless otherwise indicated.

3.05 CLEANING
A. Clean tile and grout surfaces.

3.06 PROTECTION
A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION
SECTION 09 6500
RESILIENT FLOORING

PART 1  GENERAL
1.01 SECTION INCLUDES
   A. Resilient base.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
   A. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

1.04 DELIVERY, STORAGE, AND HANDLING
   A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
   B. Store all materials off of the floor in an acclimatized, weather-tight space.

1.05 FIELD CONDITIONS
   A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2  PRODUCTS
2.01 RESILIENT BASE
   A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
      1. Manufacturers:
      2. Height: 4 inch (100 mm).
      3. Thickness: 0.125 inch (3.2 mm).
      5. Color: As indicated on drawings.

PART 3  EXECUTION
3.01 EXAMINATION
   A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
   B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

3.02 PREPARATION
   A. Clean substrate.

3.03 INSTALLATION - RESILIENT BASE
   A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
   B. Install base on solid backing. Bond tightly to wall and floor surfaces.

3.04 CLEANING
   A. Remove excess adhesive from floor, base, and wall surfaces without damage.
   B. Clean in accordance with manufacturer's written instructions.

END OF SECTION
PROCEDURAL NOTES

COORDINATION

GENERAL:

A. This specification specifies Owner furnished and installed carpet.
B. Resilient base is no longer included as part of Owner furnished and installed carpet. Carpet installer may include and install resilient base but is not required to do so. See Section 09 6513 'Resilient Base And Accessories'.
C. ‘Sheet Carpeting Design Criteria’ requirements are specified in Attachment of this specification.
D. Carpet Manufacturers are responsible that concrete slab Alkalinity and Concrete Moisture Vapor Emission Rate (MVER) Testing for each Project is within Carpet Manufacturer’s acceptable levels before installation of Owner Furnished carpet.

SECTION 09 6816

SHEET CARPETING: Back Cushion, Direct Glue
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But Is Not Limited To:
   1. Coordination, sequencing, and scheduling installation of Owner-Furnished carpet, carpet base, carpet accessories, leveling compounds as described in Contract Documents and including following:
      a. Pre-Installation Conference held in conjunction with Section 09 6813.
      b. Maintain Building Ambient Conditions including normal levels of humidity, lighting, heating, and air conditioning for acceptability for beginning floor preparation and carpet installation.
      c. Protection of carpet after installation of carpeting as required.

1.2 REFERENCES

A. Association Publications:
      a. CRI Indoor Air Quality (IAQ):
         1) CRI Green Label Plus Certification.

B. Reference Standards:
   1. The Carpet and Rug Institute (CRI):
      b. CRI TM-102, 'School Carpet Minimum Average Specifications'.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate completion of carpet installation with other trades.

B. Pre-Installation Conference:
   1. Participate in MANDATORY pre-installation conference as specified in Section 09 0503 and held jointly with Section 09 6813 pre-installation conference.
   2. Schedule pre-installation conference before installation of flooring system.
   3. Conference may be held at project site or another convenient site. Participants may also attend by video or audio conference if approved by Project Manager.
   4. Schedule conference after substrate preparation and ONE (1) week before installation of flooring system.
   5. In addition to agenda items specified Section 01 3100 and Section 09 0503, review following:
      a. Review Owner’s Representative schedule for furnishing and installation carpet.
      b. Review Flooring Manufacturer's installation conditions verification procedure and requirements.
      c. Review Building Ambient Conditions including normal levels of humidity, lighting, heating, and air conditioning for acceptability for beginning floor preparation and carpet installation.
      d. Review cleaning and disposal requirements.
      e. Review protection requirements of carpet after installation of carpeting.

C. Scheduling:
   1. Notify Flooring Installer when Building Ambient Conditions requirements are met before installation of flooring system.
   2. Notify Owner’s Representative to coordinate installation of carpet.
1.4 SUBMITTALS

A. Closeout Submittals:
   1. Include following in Operations and Maintenance Manual specified in Section 01 7800:
      a. Warranty Documentation:
         1) Copy of Warranty.
      b. Record Documentation:
         1) Owner will provide Project Carpet Request Documentation forms in both hard copy and
            digital format:
            a) Carpet Request Information Sheet.
            b) Carpet Vendor Quotation.
            c) Carpet Preinstallation Meeting Agenda.
            d) Carpet Installation Notice to Proceed or Cancel.
            e) Carpet Inspection and Completion.
            f) Carpet Overage Report and Completion.
            g) Carpet Quotation Change Request.

B. Maintenance Material Submittals:
   1. Extra Stock Materials:
      a. Leave excess pieces of carpet, 6 feet square (1 800 sq mm) or larger and 25 lineal feet
         (7.620 m) minimum of carpet cove base.
      b. Roll up and tie securely.

1.5 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. All products provided will meet requirements of all federal, state, and local codes having
      jurisdiction.
   2. Label meeting Federal Labeling Requirements, as stated in Textile Products Identification Act
      under Federal Trade Commission, shall be attached to certification samples and products
      delivered.

B. Qualifications: Section 01 4301 applies, but is not limited to following:
   1. Carpet Installer Qualifications:
      a. Certified CFI Master or Contract II grade installer or FCIB certified.
      b. Not less than five (5) years of experience in installation of commercial carpet tile of type,
         quantity and installation methods similar to work of this section.
      c. Qualified and approved by Carpet Manufacturer.
   2. Carpet Manufacturer Qualifications:
      a. Not less than five (5) years of production experience, whose published literature clearly
         indicates general compliance of products with requirements of this section.
      b. Category One Approved Carpet Manufacturers:
         1) Approval subject to agreement process approval.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General:
   1. Comply with instructions and recommendations of Manufacturer for special delivery, storage, and
      handling requirements.

B. Delivery and Acceptance Requirements:
   1. Deliver materials and accessories necessary for completion of carpet installation to site before
      beginning installation of carpet.
   2. Do not deliver materials before date scheduled for installation.
   3. Transport carpet in manner that prevents damage and distortion. Bending or folding individual
      carpet rolls or cuts from rolls is not recommended. When bending or folding is unavoidable for
delivery purposes, carpet is required to be unrolled and allowed to lie flat immediately upon arrival at installation site.

C. Storage and Handling Requirements:
1. Store carpet and related materials in a climate-controlled, dry space.
2. Protect carpet from soil, dust, moisture and other contaminants and store on a flat surface.
3. Stacking heavy objects on top of carpet rolls or stacking more than three rolls is prohibited.

1.7 FIELD CONDITIONS

A. Ambient Conditions:
1. Building Conditions:
   a. Conditions inside building shall be brought to levels to be normal at occupancy of building. Conditions include normal levels of humidity, lighting, heating, and air conditioning. (HVAC must be in operation thru out carpet installation):
      1) Carpet installation is not to begin until HVAC system is operational and following conditions are maintained for at least forty-eight (48) hours before, during and seventy-two (72) hours after completion:
         a) Carpet is to be installed when indoor temperature is between 65º - 95º F (18º - 35º C) with maximum relative humidity of 65%.
         b) Substrate surface temperature should not be less than 65º F (18º C) at time of installation.
         c) Do not allow temperature of indoor carpeted areas to fall below 50º F (10º C), regardless of age of installation.
      2) Maintain fresh air ventilation after installation for seventy-two (72) hours minimum or until lingering odors are gone.
   2. Concrete Slab:
      a. General:
         1) Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive.

1.8 WARRANTY

A. Manufacturer Warranty:
1. Provide Carpet Manufacturer's standard Warranty which includes following:
   a. Warranty shall cover defects in installation, workmanship, and installation materials.
   b. Warranty includes specific workmanship warranties for delamination, edge raveling, fuzzing, pilling, and other textural changes which can be controlled through proper manufacturing (no fraying, zipper ing, delamination, edge raveling, fuzzing, pilling in carpet is acceptable for any reason).
   c. Warranty terms will include inspection of defective area within fifteen (15) days of receipt of written notice from Owner and completion of corrective work within forty-five (45) days, unless other arrangements are made in writing with Owner on case-by-case basis.
   d. Carpet defect or installation defect:
      1) Carpet Manufacturer may use any reasonable means to cure first three (3) breaches of warranty affecting an area of carpeting bounded by natural breaks such as doorways, stairs, rostrum and platform ('affected carpet area'). Such cure must preserve as uniform a blended appearance, acceptable to Carpet Manufacturer and Owner, as exists throughout Installation Site at time of breach.
      2) If carpet defect or installation defect continues to appear after three (3) separate notices for correction from Owner, replace carpet where defects have occurred.
   e. If Carpet Manufacturer follows installation requirements of Section 09 0503 'Floor Substrate Preparation' Carpet Manufacture accepts liability of carpet installation for said given time as outlined in Special Warranty regardless of any climate or condition changes affecting RH levels of floor substrate.

2. Special Warranty:
a. Sheet Carpeting:
1) General:
   a) Appearance Retention to be provided with Special Warranty requirements if not already included in Standard Warranty.
2) Meetinghouse, Mission Office, and O&M / R&I:
   a) Owner Carpet Program Product: Provide twenty (20) year minimum or Carpet Manufacturer’s better Warranty on carpet system.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED PRODUCTS

A. Category One Approved Manufacturers. See Section 01 6200 for definitions of Categories:
   1. Materials supplied for carpet installation shall be complete package from specified Carpet Manufacturer:
         1) Contact Information: Tracy Riddle - cell (801) 580-5147 fax (866) 861-7522 Tracy.Riddle@Tarkett.com.

B. Materials:
   1. Carpet:
      a. Category One Approved Manufacturer.
         a) Tandus Centiva: Ensign II, Color: Sapphire II #86653.

   2. Carpet Base:
      a. 4-1/2 inch (115 mm) wide base without cushion backing:
         1) Top edge of base serged with 1-1/4 inch (32 mm) polyester binding fabric.
         2) Roll edges of binding fabric under and sew along top edge of carpet cove base.
      b. Carpet:
         1) Category One Approved Products. See Section 01 6200 for definitions of Categories:

2.2 ACCESSORIES

A. Carpet Accessories: Snap-in vinyl reducer strips and vinyl track.

B. Floor Leveling Compound, Floor Patching Compound, And Latex Underlayment: As recommended and approved by Carpet Manufacturer.

PART 3 - EXECUTION.

3.1 EXAMINATION

A. Verification of Conditions:
   1. Verify required ambient conditions inside building for required normal levels of humidity, lighting, heating, and air conditioning have been maintained for at least forty-eight (48) hours before and during carpet installation and seventy-two (72) after installation of carpet.

B. Evaluation and Assessment:
   1. Carpet Areas:
      a. Variation In Grade:
1) Plus or minus 1/8 inch (3 mm) in any 10 foot (3 meter) of floor slab and distance between high point and low point of slab of 1/2 inch (13 mm).

b. Testing Procedure:
   1) Place ends of straightedge on 3/8 inch (10 mm) high shims.
   2) Floor is satisfactory if 1/4 inch (6 mm) diameter steel rod rolled under straightedge will not touch anywhere along 10 foot (3 meter) length and 1/2 inch (13 mm) diameter steel rod will not fit under straightedge anywhere along 10 foot (3 meter) length.

c. Notify Owner’s Representative in writing if floor surface is not acceptable to install carpet:
   1) Do not lay carpet over unsuitable surface. Commencing installation constitutes acceptance of floor and approval of existing conditions.

3.2 PREPARATION

A. Carpet Areas:
   1. Flooring Preparation:
      a. Owner-Furnished Product Supplier’s Responsibility:
         1) Prepare floor substrate in accordance with ‘CRI Carpet Installation Standard’ best practices to receive carpet installation and to provide installation that meets warranty requirements.
         2) Verify concrete surface cured, clean, dry, and free of foreign substances that will compromise carpet and/or installation.
      b. Concrete floor slab patching:
         1) Cracks, chips and joints must be properly patched or repaired.
      c. Concrete surface cured, clean, dry, and free of foreign substances that will compromise carpet and/or other flooring installations:
         1) Removal of curing compounds.
         2) Remove paint, sealer, grease, oil, silicone sealants, and other materials incompatible with flooring adhesives.
         3) Removal of overspray from painted walls (essential so glue will stick).
      d. Vacuum and damp mop floor areas to receive flooring before flooring installation.
   2. Relaxing / Conditioning Carpet:
      a. Highly recommended that carpet be unrolled and allowed to relax in installation area for time period that conforms to requirements of manufacturer of product being installed:
      b. Protect carpet adequately from soil, dust, moisture and other contaminants.
      c. Sundry items, such as adhesives, should also be conditioned.
   3. Carpet Accessories:
      a. Owner-Furnished Product’s Responsibility:
         1) Sundry items, such as adhesives, shall be conditioned to building ambient conditions before use.

3.3 INSTALLATION

A. Carpet:
   1. General:
      a. Install carpet and carpet base in accordance with ‘CRI Carpet Installation Standard’ and Manufacturer’s written instructions supplied with product.
      b. Adhesion of carpet cushion (or secondary backing) to floor substrate and adhesion of carpet primary and secondary backings shall be continuous on floor surface so there are no bubble, ridges, or any separation of carpet from backings or backing from floor substrate caused by failure of carpet, backings or cushion, and adhesives as a system.
      c. Install carpet under edge of metal thresholds where possible. Use specified carpet accessories at exposed edges.
      d. Generally, install carpet on Rostrum first, Chapel second, and then remainder of building.
   2. Seaming Requirements:
      a. Seal seams in accordance with Carpet Manufacturer's instructions and according to CRI Carpet Installation Standard (2009) as applicable. Seam carpet base only at inside corners.
b. No seam separation in carpet and no more observable seams from any standing position than that which is unavoidable using best seaming materials and practices available at time of installation.

c. Lay rooms parallel to respective Corridors. Seam to permit best use of available carpet.

d. Quarter turning allowed only at cross-Corridors longer than 24 feet (7.315 m).

e. Use single or double seams at doorways (single seams preferred). Run nap of pieced carpet in same direction.

f. Lay carpet lengthwise in Chapel.

g. Lay carpet lengthwise on Rostrum, parallel to Rostrum seating.

B. Carpet Base:
1. Precut base so seams occur only at inside corners.
2. Scribe base to floor.
3. Spread adhesive over back side of base up to bottom of serging on edge or apply three 3/16 inch (4.76 mm) minimum diameter beads of adhesive placed one inch apart on back of base with top bead placed 2 inch (50 mm) down from serged edge of base and spread adhesive over back surface of base up to bottom edge of serging.
   a. Bird’s mouth finish should only be required when door frame is flush with wall.
   b. If bird’s mouth is required, terminate at door frames or vertical trim with 45 degree angle, bird mouth cut so serged edge turns down to contact frame or trim.
4. Do not allow adhesive beyond edge of base. Remove excess adhesive.
5. Do not use staples, nails, screws or other mechanical fasteners.

3.4 FIELD QUALITY CONTROL

A. Field Inspections:
1. Carpeting:
   a. Unacceptable carpet after installation shall include but not be limited to:
      1) Delaminating carpet from backings.
      2) Fiber loss less than specified.
      3) Edge raveling.
      4) Fuzzing of carpet fibers.
      5) Pilling of carpet fibers.
      6) Appearance retention less than control samples attached to Agreement.
      7) Dye bleeding.
      8) Zippering fibers in carpet.
      9) Color streaking.
     10) Irregular tufts of fiber.
   b. Unacceptable workmanship shall include but not be limited to:
      1) Improper floor preparation before installation.
      2) Failure of adhesive to completely adhere carpet to floor resulting in bubbles, ridges, or ripples where carpet has separated from floor.
      3) Seams that do not comply with specified requirements:
         a) Raveled or untrimmed seams.
         b) Seams not sealed, level, straight, or even.
         c) Open seams.
         d) Seams visibly open when viewed by Project Manager from standing position.
      4) Sequence rolls, commercial match issues created by rolls being installed out of sequence will require correction or replacement.
      5) Failure to properly install carpet next to walls and door frames to eliminate gaps or puckering of carpet.
      6) Use of unspecified carpet.
      7) Carpet base ends not finished to terminate at door frames or vertical trim shall have 45 degree angle ‘birdsmouth’ finish.
      8) Adhesive exposed on carpet, on carpet base, beyond edges of carpet base, and on other surfaces of building.
      9) Carpet base that is not scribed to fit against floor with no gaps.
10) Carpet base attached by means other than acceptable carpet base adhesive.

B. Non-Conforming Work:
   1. Carpeting:
      a. Basis of Acceptable Carpeting: Source Quality Control Testing:
         1) Carpet products not meeting Design Criteria and Source Quality Control Testing of this
            specification will be considered unacceptable carpeting.
      b. Unacceptable Carpeting:
         1) Unacceptable carpeting will be rejected and shall be repaired or replaced at no
            additional cost to Owner. Owner’s Representative will determine reasonable location of
            acceptable transition points for removal of unacceptable carpet. Minimum replacement
            size shall be:
            a) Between nearest existing seams.
            b) Between natural transition points or 12 feet (3.6 meters) of running length.

3.5 CLEANING

A. General:
   1. Carpeting:
      a. Carpet Installer’s Responsibility:
         1) Remove any soiling and/or staining from carpet.
         2) Remove excessive adhesive with manufacturer recommended adhesive removers.

B. Damage to building:
   1. Carpeting:
      a. Carpet Installer’s Responsibility:
         1) Carpet Installer responsible for cleaning and repair of all damaged surfaces to their
            original condition from carpet installation.

C. Waste Management:
   1. Contractor’s Responsibility:
      a. Provide adequate waste receptacles (dumpsters) and dispose of Owner Furnished materials
         from building and property as specified in Section 01 7400.
   2. Carpet Installer’s Responsibility:
      a. All work areas are to be kept clean, clear and free of debris at all times.
      b. Disposal of rubbish, wrapping paper, scraps, and trimmings in provided dumpster(s).

3.6 PROTECTION

A. Protection of Carpeting:
   1. Contractor's Responsibility:
      a. No traffic of any kind on newly installed carpet for minimum of twenty-four (24) hours after
         installation is completed.
      b. No wheeled traffic of any kind placement of furniture or equipment on carpet for minimum of
         forty-eight (48) hours after completion of carpet installation.
      c. Protect carpet adequately from soil, dust, moisture and other contaminants after carpet
         installation.
      d. Protect carpet from abuse, vandalism, or damage occurring after installation is complete.
SECTION 09 9113
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Surface preparation.
B. Field application of paints.
C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Floors, unless specifically indicated.
   7. Concealed pipes, ducts, and conduits.

1.02 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

1.03 DELIVERY, STORAGE, AND HANDLING
A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.04 FIELD CONDITIONS
A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
C. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

2.02 PAINTS AND FINISHES - GENERAL
A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Supply each paint material in quantity required to complete entire project's work from a single production run.
3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

2.03 PRIMERS
A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
   1. Alkali Resistant Water Based Primer.

2.04 ACCESSORY MATERIALS
A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
B. Patching Material: Latex filler.
C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
C. Test shop-applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION
A. Clean surfaces thoroughly and correct defects prior to application.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
D. Seal surfaces that might cause bleed through or staining of topcoat.
E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

3.03 APPLICATION
A. Apply products in accordance with manufacturer's written instructions.
B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
C. Apply each coat to uniform appearance.
D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING
A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION
A. Protect finishes until completion of project.
B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION
SECTION 09 9123
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.
B. Field application of paints, stains, and varnishes.
C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Floors, unless specifically indicated.
   7. Concealed pipes, ducts, and conduits.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.04 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
C. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Supply each paint material in quantity required to complete entire project's work from a single production run.
3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

2.03 PRIMERS
   A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
      1. Alkali Resistant Water Based Primer.

2.04 ACCESSORY MATERIALS
   A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
   B. Patching Material: Latex filler.
   C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
   B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
   C. Test shop-applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION
   A. Clean surfaces thoroughly and correct defects prior to application.
   B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
   C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
   D. Seal surfaces that might cause bleed through or staining of topcoat.

3.03 APPLICATION
   A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
   B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
   C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
   D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
   E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING
   A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION
   A. Protect finishes until completion of project.
   B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION
DIVISION 10 -- SPECIALTIES
10 2601 - Wall and Corner Guards
10 2800 - Toilet, Bath, and Laundry Accessories
10 4400 - Fire Protection Specialties
10 7430 - Alum Steeple
SECTION 10 2601
WALL AND CORNER GUARDS

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Bumper rails.
B. Corner guards.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS
A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Indicate physical dimensions, features, anchorage details, and rough-in measurements.
C. Samples: Submit two sections of bumper rail, 24 inch (600 mm) long, illustrating component design, configuration, color and finish.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Wall and Corner Guards:
   3. Inpro; ______: www.inprocorp.com/#sle.
   5. Trim-Tex, Inc; ______: www.trim-tex.com/#sle.

2.02 COMPONENTS
A. Bumper Rails: Factory- or shop-fabricated, with preformed end caps and internal and external corners:
   1. Material: Polyethylene terephthalate (PET or PETG); PVC-free, color as selected from manufacturer's standard colors.
   2. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   4. Return rail to wall.
B. Corner Guards - Surface Mounted:
   1. Material: High impact vinyl with full height extruded aluminum retainer.
   2. Width of Wings: 2 inches (51 mm).
   3. Corner: Square.
   4. Color: As selected from manufacturer's standard colors.
   5. Length: One piece.

2.03 FABRICATION
A. Fabricate components with tight joints, corners and seams.
B. Form end trim closure by capping and finishing smooth.

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to wall framing members only.

B. Position top of bumper rail 36 inches (____ mm) from finished floor. Coordinate with folding chair heights.

C. Position corner guard 4 inches (____ mm) above finished floor to 60 inches (____ mm) high.

D. Terminate rails 12 inches (____ mm) short of door opening.

END OF SECTION
SECTION 10 2800
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL
1.01 SECTION INCLUDES
A. Commercial toilet accessories.
B. Under-lavatory pipe supply covers.
C. Diaper changing stations.
D. Utility room accessories.

1.02 REFERENCE STANDARDS
B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

1.03 SUBMITTALS
A. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS
2.01 MATERIALS
A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
B. Keys: Provide 4 keys for each accessory to Owner; master key lockable accessories.
C. Stainless Steel Sheet: ASTM A666, Type 304.
D. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
E. Adhesive: Two component epoxy type, waterproof.
F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.02 FINISHES
A. Stainless Steel: Satin finish, unless otherwise noted.

2.03 COMMERCIAL TOILET ACCESSORIES
A. Toilet Paper Dispenser: Double roll, surface mounted, for coreless type rolls.
B. Paper Towel Dispenser: Folded paper type, stainless steel, semi-recessed, with viewing slots on sides as refill indicator and tumbler lock.
   1. Capacity: 300 C-fold minimum.
C. Waste Receptacle: Stainless steel, freestanding style.
D. Mirrors: Stainless steel framed, 1/4 inch (6 mm) thick annealed float glass; ASTM C1036.
   1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
   2. Frame: 0.05 inch (1.3 mm)angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
E. Grab Bars: Stainless steel, textured surface.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

b. Dimensions: 1-1/4 inch (32 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, exposed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
c. Finish: Satin.
d. Length and Configuration: As indicated on drawings.

F. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.

2.04 UNDER-LAVATORY PIPE AND SUPPLY COVERS
A. Under-Lavatory Pipe and Supply Covers:
   1. Insulate exposed drainage piping including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.

2.05 DIAPER CHANGING STATIONS
A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
   1. Material: Polyethylene.

2.06 UTILITY ROOM ACCESSORIES
A. Mop and Broom Holder: 0.05 inch (1.3 mm) thick stainless steel, Type 304, hat-shaped channel.
   1. Length: 36 inches (900 mm).

PART 3 EXECUTION
3.01 EXAMINATION
A. Verify existing conditions before starting work.
B. Verify exact location of accessories for installation.

3.02 INSTALLATION
A. Install accessories in accordance with manufacturers’ instructions in locations indicated on drawings.
B. Install plumb and level, securely and rigidly anchored to substrate.
C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

END OF SECTION
SECTION 10 4400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. Fire extinguishers.
   B. Fire extinguisher cabinets.
   C. Accessories.

1.02 SUBMITTALS
   A. Product Data: Provide extinguisher ratings and classifications, color and finish, and anchorage details.
   B. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

PART 2 PRODUCTS

2.01 FIRE EXTINGUISHERS
   A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
      2. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to ___ degrees F (___ degrees C).

2.02 FIRE EXTINGUISHER CABINETS
   A. Cabinet Configuration: Semi-recessed type.
      1. Size to accommodate accessories.
   B. Door Glazing: Acrylic plastic, clear, 1/8 inch (3 mm) thick, flat shape and set in resilient channel glazing gasket.
   C. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
   D. Finish of Cabinet Exterior Trim and Door: Baked enamel, White color.
   E. Finish of Cabinet Interior: White colored enamel.

2.03 ACCESSORIES
   A. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Verify existing conditions before starting work.
   B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION
   A. Install in accordance with manufacturer's instructions.
   B. Install cabinets plumb and level in wall openings, ____ inches (____ mm) from finished floor to inside bottom of cabinet.
   C. Secure rigidly in place.
   D. Place extinguishers in cabinets and on wall brackets.

END OF SECTION
STEEPLE BASE MEMBRANE:
   A. Secondary Underlayment Membrane under Steeple:
      1. Steep Roof: Roof Installer to install Secondary Underlayment Membrane under Steeple as shown on Contract Drawings.

SECTION 10 7430
ALUMINUM STEEPLE

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install steeple as described in Contract Documents, including application of sealants.

B. Related Requirements:
   1. Section 05 0503: 'Shop-Applied Metal Coatings' for quality of metal primer.
   2. Section 05 0523: 'Metal Fastening' for quality of anchor rods.
   3. Section 05 1223: 'Structural Steel for Building' for quality of metal support angles.
   5. Section 07 7201: 'Roofing Accessories: Steeple' for square tube pipe boot at steeple base.
   7. Section 26 4100: 'Facility Lightning Protection' for lightning protection system from steeple to ground level.
1.2 REFERENCES

A. Association Publications:
   1. American Architectural Manufacturers Association (AAMA):

B. Reference Standards:
   1. American Society of Civil Engineers (ASCE):
      a. ASCE 7, 'Minimum Design Loads for Buildings and Other Structures'.
   2. ASTM International:
      a. ASTM A36/A36M-14, 'Standard Specification for Carbon Structural Steel'.
      a. Chapter 15, 'Roof Assemblies And Rooftop Structures':
         1) Section 1509, 'Rooftop Structures':
            a) 1509.5, ‘Towers, Spires, Domes, and Cupolas’.
      b. Chapter 16, 'Structural Design':
         1) Section 1609 'Wind Loads'.
         2) Section 1613 'Earthquake Loads'.

1.3 QUALITY REQUIREMENTS

A. Sequencing:
   1. Steeple Support Enclosure to be completed before Steeple is installed.

B. Schedule:
   1. Provide eight (8) weeks minimum from approval of Shop Drawings to beginning of installation of Steeple.

1.4 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Shop drawings and calculations stamped and signed by Engineer in accordance with local building code requirements.
      b. Show design load parameters, dimensions, adjacent construction, materials, thicknesses, core material thicknesses, fabrication details, required clearances, field jointing, tolerances, colors, finishes, method of support, integration of components, and attachment connections.
      c. As required for proper handling and erection.

B. Informational Submittals:
   1. Manufacturer Instructions:
      a. Steeple Fabricator's erection instructions and drawings.
      b. Steeple Fabricator's maintenance instructions.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Maintenance instructions.
      b. Warranty Documentation:
         1) Include final, executed copy of warranty.
1.5 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Engineer registered in state in which Project is located.

B. Qualifications. Requirements of Section 01 4301 applies, but not limited to the following:
   1. Steeple Fabricator specializing in aluminum steeple fabrication with ten (10) years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Protect components during shipment by means of crates or padding so they arrive at project undamaged.
   2. Unload and inspect components for imperfections or for damage incurred during shipping and transit procedures.
   3. Replace damaged components at no additional cost to Owner.

B. Storage And Handling Requirements:
   1. Maintain protection during storage on site before installation.

1.7 WARRANTY

A. Manufacturer Warranty:
   1. Provide Steeple Fabricator's written warranty for material, workmanship, and installation.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Fabricators:
   1. Category Four Approved Fabricators. See Section 01 6200 for definitions of Categories:
      a. Campbellsville Industries Inc, Campbellsville, KY, (800) 467-8135, Fax: (502) 465-6839
      b. Munns Manufacturing, Tremonton, UT, phone (888) 774-7348, (435) 257-5673, Fax: (435) 257-3842

B. Performance:
   1. Design Criteria:
      a. Design and construct steeple to withstand a wind speed of 100 mph (161 kph) as defined by Section 1609 ‘Wind Loads’ of the International Building Code unless local codes require greater forces or per seismic requirements whichever are greater.
      b. Design and construct steeple for a Seismic Design Category D per Section 1613 ‘Earthquake Loads’ of the International Building Code unless local codes require greater forces or per wind requirements whichever are greater.

C. Materials:
   1. Base: Structural steel angles engineered and sized for steeple size and meeting requirements of ASTM A36.
   2. Steeple:
      b. Exterior Covering:
         1) Aluminum Cladding: 0.032 inch (0.813 mm) thick minimum, alloy 3003-H14 minimum.
      c. Louvers:
1) Formed from 0.032 inch (0.813 mm) thick aluminum skin.
2) Aluminum insect screen backing, 18x18 mesh, held taut with aluminum strapping.
3) Provide water pan at base of louver with proper weepage.
4) Provide formed supports at back of louver blades for widths exceeding 36 inches (900 mm).

d. Lightning Protection:
1) Provide clamp on structural member at bottom of tower or pigtail for connection of lightning protection cable provided under Section 26 4100.
2) UL approved for intended use.
3) Isolate dissimilar materials or provide components of compatible materials.

D. Fabrication:
1. Do not use wood or wood products in fabrication of steeple.
2. Base:
   a. Paint steel elements with two (2) heavy coats of metal primer.
   b. Isolate aluminum framing in contact with steel with material compatible with both aluminum and steel to prevent electrolysis.
   c. Secure structural aluminum framing to steel base with appropriate size stainless steel bolts, with lock nuts and washers.
3. Steeple:
   a. Framing: Fasten aluminum framing together with cold driven rivets, alloy 6061-T6, not loaded in tension and with 1 inch (25 mm) minimum spacing.
   b. Exterior Covering: Use lock seams and conceal exterior fasteners as much as possible.
   c. Cornices:
      1) Form true to dimensions with vertical joints kept to a minimum.
      2) Reinforced interior cornice profiles to resist wind loading during transit.
   d. Finial: Formed aluminum of specified size and tapered to point, with spun aluminum ball.

E. Finish:
1. Fluorocarbon Carbon:
   a. Comply with AAMA 2605.
   b. Polyvinylidene Fluoride (PVDF) Resin-base finish (Kynar 500 or Hylar 5000) containing seventy (70) percent minimum (PVDF) in resin portion of formula and providing pencil hardness of 3H.
      1) Thermo-cured two-(2) coat system consisting of corrosion inhibiting epoxy primer and topcoat factory-applied over properly pre-treated metal:
   c. Dip spun or fabricated shapes in caustic etch, coat with primer or epoxy and finish with exterior vinyl finish.
   d. Finish shall be of such quality that shearing or forming encountered during fabrication will not separate finish from aluminum.
   e. Color:
      1) Steeple: White.
      2) Steeple windows (if noted on Contract Drawings): Matte Black.
   f. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
      1) BASF.
      2) PPG Industries, Inc.
      3) Valspar Corporation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
1. Verify substrates and structural framing are ready to receive work and dimensions are as shown on shop drawings.
2. Verify site conditions are suitable and accessible for delivery and installation.
3. Before steeple placement, have support framing inspected by licensed structural engineer acceptable to Owner to insure supporting elements are properly installed. Report problems with installation of supporting elements to Owner in writing before installing steeple.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using Steeple Fabricator's recommendations for substrate.

3.3 INSTALLATION

A. Special Techniques:
   1. Install in accordance with Steeple Fabricator's handling and erection directions.
   2. Clean all soiled and dirty areas and touch up any scratches or abrasions to finish before lifting into position.
   3. Secure steel base to roof framing as described in Contract Documents.
   4. Isolate dissimilar metals.
   5. Bolted connections with Steeple Fabricator's sealant and apply to clean and dry surfaces.
   6. Seal joints between steeple and other substrates with sealants recommended by Steeple Fabricator.

B. Interface With Other Work:
   1. Coordinate with other trades as required to assure proper and adequate installation.
   2. Install after square tube pipe boot as specified in Section 07 7201: 'Roofing Accessories: Steeple', roofing membrane included for project, and after inspection to confirm that roofing membrane is weather tight.

3.4 FIELD QUALITY CONTROL

A. Non-Conforming Work:
   1. Remove installed steeple that has wrinkled or oil canning appearance, repair or replace and reinstall at no additional cost to Owner.

3.5 CLEANING

A. Installer to clean fabrications of foreign material using cleaning methods recommended in writing by Steeple Fabricator.

3.6 PROTECTION

A. General Contractor Responsibility:
   1. Protect steeple after installation, as recommended by Steeple Fabricator, until completion of Project.

END OF SECTION
DIVISION 11 -- EQUIPMENT

11 3300 - Retractable Stairs
PART 1 GENERAL

1.1 SECTION INCLUDES
A. Manual disappearing stairways.

1.2 REFERENCES
A. ANSI A14.9: Safety Requirements for Ceiling Mounted Disappearing Climbing Systems.

1.3 SUBMITTALS
A. Submit under provisions of Section 01300.
B. 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.
C. Shop Drawings for Stairs:
   1. Plan and section of stair installation.
   2. Indicate rough opening dimensions for ceiling and/or roof openings.

1.4 DELIVERY, STORAGE, AND HANDLING
A. Store stairway until installation inside under cover in manufacturer's unopened packaging. If stored outside, under a tarp or suitable cover.

1.5 WARRANTY
A. Limited Warranty: One year against defective material and workmanship, covering parts only. Defective parts, as deemed by the manufacturer, will be replaced at no charge, freight excluded, upon inspection at manufacturer's plant.

PART 2 PRODUCTS

2.1 MANUFACTURERS
A. Acceptable Manufacturer: Precision Ladders, LLC, P. O. Box 2279; Morristown, TN 37816-2279; Tel: 423-586-2265; Fax: 423-586-2091; www.PrecisionLadders.com
B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 MANUAL DISAPPEARING STAIRWAY.
A. Manual Disappearing Stairway.
   1. Standard Model: Super Simplex Disappearing Stairway as manufactured by Precision Ladders LLC. Stairs for ceiling heights 7'-0" – 12'-0": Model 1000 (ceiling height in inches). Stairs for ceiling heights 12'-1" – 13'-6": Model 2000 (ceiling height in inches).
B. Performance Standard: Unit shall comply with ANSI A14.9, Commercial Type, for rough openings between 27 inches to 39 inches. Residential Type for rough openings between 22-1/2" and 27". Stairway capacity shall be rated at 500 lbs.
C. Accessories:
   1. Steel pole to aid opening and closing stairways.
   2. Stairs for ceiling heights 9’-10” – 12’-0” shall be equipped with a patented Precision Fold Assist to aid in folding and unfolding of sections. Stairs for ceiling heights 12’-1” – 13’-6” shall be equipped with 2 Fold Assists. Precision Fold-Assist is optional on stairways for ceiling heights of 9’ 9” and below.
   3. Keyed lock for door (standard on fire-rated models, optional on non-fire-rated models).
D. Components:
   1. Ceiling Opening
      a. Ceiling height of 9’ 9” or less requires an opening of 30” x 54”
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

b. Ceiling heights from 9’ 10” – 12’ 0” require opening of 30” x 64”
c. Ceiling heights from 12’ 1” – 13’ 6” require opening of 22 ½” x 72”

2. Stairway Stringer: 6005-T5 Extruded aluminum channel 5” x 1” x 1/8”; tri-fold design; steel blade type hinges; adjustable feet with plastic Mar-guard. Pitch shall be 63°.


4. Railing: Aluminum bar handrail riveted to stringers, upper section only.

5. Frame:
   a. If ceiling to floor (or roof deck) above is under 12”, frame shall be 1/8” steel formed channel, box.
   b. When ceiling to floor (or roof deck) above is 12” or greater, the frame shall be 1/8” steel, 63° (with built-in steps) on the hinge end, 90° on the other end, custom depth to fill distance from ceiling to floor above. This custom frame will require a longer opening in the floor above than is required at the ceiling level.

6. Door Panel
   a. Standard (non-fire rated) door shall be constructed of 1/8 inch (3 mm) aluminum sheet attached to stairway frame with a steel piano hinge. Door overlaps bottom flange of frame. Eye bolt accommodates pole for opening and closing door.
   b. On fire-rated models, the door panel shall be constructed of 20 gauge steel and have a 2 hour fire rating for use in fire-rated ceiling assemblies as issued by Warnock-Hersey or other appropriate independent testing/licensing agency.

7. Hardware:
   a. Steel blade type hinge connecting stringer sections. Zinc plated and chromate sealed.
   b. Steel operating arms, both sides. Zinc coat with clear trivalent chromate.
   c. Double acting steel springs and cable, both sides.
   d. Rivets rated at 1100 lb (499 kg) shear strength each.
   e. Steel section alignment clips at stringer section joints.
   f. Molded rubber guards at corners of aluminum door panel.


2.3 FABRICATION
   A. Completely fabricate ladder ready for installation before shipment to the site.

PART 3 EXECUTION

3.1 EXAMINATION
   A. Do not begin installation until rough opening and structural support have been properly prepared.
   B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
   C. Examine materials upon arrival at site. Notify the carrier and manufacturer of any damage.

3.2 INSTALLATION
   A. Install in accordance with manufacturer's instructions.

3.3 PROTECTION
   A. Protect installed products until completion of project.
   B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION
DIVISION 21 -- FIRE SUPPRESSION
21 1313 WET-PIPE SPRINKLER SYSTEMS
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install complete wet-pipe fire sprinkler system as specified in Contract Documents.
   2. Furnish and install Firestop Penetration Systems for fire sprinkler system penetrations as described in Contract Documents.

B. Related Requirements:
   1. Section 07 8400: ‘Firestopping’ for quality of Penetration Firestop Systems to be used on Project and submittal requirements.
   2. Section 28 3101: ‘Fire Detection and Alarm System’ for fire detection and alarm annunciation panels including connection of tamper switches and flow detectors to alarm system and furnishing and installing of low temperature switch.

1.2 REFERENCES

A. Association Publications:
   1. Underwriters Laboratories, Inc.:

B. Reference Standards:

218036 / Garden City Assembly
21 1313 - 1
1. American Society of Mechanical Engineers:
   a. ASME B1.20.1-2013 ‘Pipe Threads, General Purpose, Inch’.
   c. ASME B16.3-2016, ‘Malleable Iron Threaded Fittings: Classes 150 and 300’.
   d. ASME B16.4-2016, ‘Gray Iron Threaded Fittings: Classes 125 and 250’.
   e. ASME B16.5-2017, ‘Pipe Flanges and Flanged Fittings’.

2. American Water Works Association:
   a. AWWA C606-15, ‘Grooved and Shouldered Joints’.

3. American Welding Society:

4. ASTM International:
   c. ASTM A234/A234M-17, ‘Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service’.

5. National Fire Protection Association:

1.3 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Size sprinkler system using NFPA 13 hydraulic calculation design method based on water supply evaluation performed at building site:
         1) On submittals, refer to sprinkler heads by sprinkler identification or model number published in appropriate agency listing or approval. Trade names and other abbreviated designations are not acceptable.
      b. Submittal Procedure:
         1) After award of Contract and before purchase of equipment, submit seven sets of shop drawings with specifications and hydraulic calculations to Fire Sprinkler Consultant and two (2) sets to local jurisdiction having authority for fire prevention for review. If pipe schedule method is used, submit copies of schedules in NFPA 13 used in sizing pipe.
         2) After integrating Fire Sprinkler Consultant's and AHJ's comments into drawings, licensed certified fire protection engineer of record who designed fire protection system shall stamp, sign, and date each sheet of shop drawings and first page of specifications and calculations.
         3) Submit stamped documents to Owner and to AHJ for fire prevention for final approval.
         4) After final approval, submit four copies of approved stamped documents to Fire Sprinkler Consultant.
         5) Failure of system to meet requirements of authority having jurisdiction and/or approved stamped construction documents shall be corrected at no additional cost to Owner.
B. Informational Submittals:
   1. Certificates:
      a. Provide one (1) copy of completed NFPA 13 'Contractor's Material and Test Certification for Aboveground Piping' as specified in 'Field Quality Control' in Part 3 of this specification:
   2. Qualification Statement:
      a. Licensed fire protection engineer or fire protection system designer:
         1) Licensed for area of Project.
         2) Certified by NICET to level three minimum.
         3) Provide Qualification documentation if requested by Fire Sprinkler Consultant or Owner's Representative.
      b. Installer:
         1) Provide Qualification documentation if requested by Fire Sprinkler Consultant or Owner's Representative.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Maintenance and instructions.
            a) List of system components used indicating name and model of each item.
            b) Manufacturer's maintenance instructions for each component installed in Project.
            c) Instructions shall include installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance and lubrication instructions.
      b. Warranty Documentation:
         1) Include copies of required warranties.
      c. Record Documentation:
         1) Include copies of approved shop drawings.
         2) Provide master index showing items included.
         3) Provide name, address, and phone number of Architect, Fire Sprinkler Consultant, General Contractor, and Fire Protection subcontractor.
         4) Provide operating instructions to include:
            a) General description of fire protection system.
            b) Step by step procedure to follow for shutting down system or putting system into operation.
         5) Provide signed copy of NFPA 13 'Contractor's Material and Test Certification for Aboveground Piping'.
   2. Instruction of Owner (as specified in Part 3 of this specification):
      a. Provide Owner with latest version of NFPA 25.

D. Maintenance Material Submittals:
   1. Extra Stock Materials:
      a. Spare sprinkler heads in the quantity recommended by NFPA 13 selected in representative proportion to quantity used in Project and in accordance with NFPA 13 (Six (6) spare sprinkler heads minimum). Do not include dry barrel Pendent and dry barrel Sidewall sprinkler heads.
      b. Provide spare heads in cabinet with sprinkler head wrench for each type of head used. After approval of cabinet and contents, mount cabinet in convenient location in Riser Room.

1.4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:
   1. Unless noted otherwise, system shall conform to:
      a. NFPA 13, 'Light & Ordinary Hazard Occupancies'.
      b. NFPA 24, 'Service Mains and Their Appurtenances, Private'.
      c. NFPA 25, 'Inspection, Testing, and Maintenance'.
      e. Requirements of local water department and local authority having jurisdiction for fire protection.
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

g. Comply with backflow prevention requirements and, if required, include device in hydraulic calculations.
h. Applicable rules, regulations, laws, and ordinances.

B. Qualifications:
1. Licensed fire protection engineer or fire protection system designer certified by NICET to level three minimum and engaged in design of fire protection systems. Engineer / designer shall:
a. Licensed for area of Project.
b. Minimum five (5) years experience in fire protection system installations.
c. Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
d. Be responsible for overseeing preparation of shop drawings, hydraulic calculations where applicable, and system installation.
e. Make complete inspection of installation.
f. Provide corrected record drawings to Owner with letter of acceptance.
g. Certify that installation is in accordance with Contract Documents.
h. Upon request, submit documentation.
2. Installer:
a. Licensed for area of Project.
b. Minimum five (5) years experience in fire protection system installations.
c. Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
d. Upon request, submit documentation.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
1. Manufacturer Contact List:
m. TYCO Fire & Building Products, Lansdale, PA www.tyco-fire.com.

B. Description:
1. Automatic wet-pipe fire sprinkler system starting at flange in Fire Riser Room and extending throughout heated portions of building.
2. Cold attic areas and roof overbuild areas over Entry Lobbies and Vestibules protected with auxiliary anti-freeze system(s).
3. Sprinklers not required in areas with fire-retardant treated wood.
4. Dry sprinkler heads preferred over and into Vestibules.

C. Performance:
1. Design Criteria:
a. Area of Application and Corresponding Design Density:
1) Serving Area and Mechanical, Electrical, and Janitorial Areas:
   a) Ordinary Hazard Group 1.
   b) Design density = 0.15 gpm per sq ft over 1,500 sq ft (140 sq m).
2) Storage Areas:
   a) Ordinary Hazard Group 2.
   b) Design density = 0.20 gpm per sq ft over 1,500 sq ft (140 sq m).
3) All Other Areas:
   a) Light Hazard.
   b) Design density = 0.10 gpm per sq ft over 1,500 sq ft (140 sq m).
4) Increase remote areas by 30 percent where ceiling / roof is sloped more than 2 inches (50 mm) per ft.
5) Remote areas may be reduced within parameters indicated in NFPA 13 for use of quick response sprinklers throughout.

b. Maximum Coverage per Sprinkler Head:
   1) Ordinary Hazard Areas:  130 sq ft (12.1 sq meters).
   2) Attic Areas:  120 sq ft (11.2 sq meters).
   3) Light Hazard Areas:  225 sq ft (20.1 sq meters).

c. Design Area shall be hydraulically most remote area in accordance with NFPA 13.
   1) Provide a 10% safety allowance under adjusted water flow supply curve.

d. Maximum velocity of water flow within piping: 20 feet (6.1 m) per sec.

D. Components:
   1. General: Use only domestically manufactured cast iron pipe fittings, valves, sprinkler heads, and other components.
      a. Pipe of foreign manufacture that meets ASTM Standards is acceptable.
      b. Ductile iron fittings of foreign manufacture are acceptable.
   2. Pipe:
      a. Schedule 40 Welded Steel:
         1) Exterior, Above Ground: Schedule 40 hot-dip galvanized welded steel meeting requirements of ASTM A53/A53M, ASTM A135/A135M or ASTM A795/A795M.
         2) Interior, Above Ground: Schedule 40 black welded steel meeting requirements of ASTM A53/A53M, ASTM A135/A135M or ASTM A795/A795M.
      3) Connections:
         a) 2 inches (50 mm) And Smaller: Screwed, flanged, or roll grooved coupling system.
         b) 2-1/2 inches (64 mm) And Larger: Flanged or roll grooved coupling system.
   3. Fittings:
      a. Usage:
         1) 2 inches (50 mm) And Smaller: Welded, screwed, flanged, or roll grooved coupling system. For use with schedule 40 carbon steel pipe.
         2) 2-1/2 inches (64 mm) And Larger: Welded, flanged, or roll grooved coupling system.
      b. Types and Quality:
         1) Screwed:
            a) Cast iron meeting requirements of ANSI B16.4 or ductile iron meeting requirements of ANSI B16.3 and ASTM A536, Grade 65-45-12.
            b) Threaded fittings and pipe shall have threads cut to ANSI B1.20.1.
            c) Do not extend pipe into fittings to reduce waterway.
            d) Ream pipe after cutting to remove burrs and fins.
         2) Flanged: Steel meeting requirements of ANSI B16.5.
         3) Welded:
            a) Carbon steel meeting requirements of ASTM A234/A234M.
         4) Roll Grooved Pipe Coupling System:
            a) Ductile iron meeting requirements of ASTM A395/A395M and ASTM A536, and UL listed.
            b) Grooved products used on Project shall be from same manufacturer. Grooving tools shall be as recommended by manufacturer of grooved products.
c) Category Four Approved Products: See Section 01 6200 for definition of Categories:

<table>
<thead>
<tr>
<th></th>
<th>Gruvlok</th>
<th>Tyco (Grinnell)</th>
<th>Victaulic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rigid Couplings</td>
<td>7401</td>
<td>772</td>
<td>Style 005</td>
</tr>
<tr>
<td>Flexible Couplings ¹</td>
<td>7000</td>
<td>705</td>
<td>Style 75</td>
</tr>
<tr>
<td>Flange Adaptors ²</td>
<td>7012</td>
<td>71</td>
<td>Style 744</td>
</tr>
<tr>
<td>Grooved Coupling Gaskets ³</td>
<td>'E' EPDM</td>
<td>Grade 'E' EPDM</td>
<td>'E' EPDM  ⁴</td>
</tr>
</tbody>
</table>

¹ Use in locations where vibration attenuation, stress relief, thermal expansion, or seismic design is required / needed.
² Class 125 or 150.
³ Temperature rated 30 to 150 deg F (minus one to plus 65 deg C). NSF-61 certified.
⁴ Grade ‘A’.

c. Use of saddle or hole cut type mechanical tees is **NOT APPROVED**.

4. Valves:

a. Butterfly Valves:
   1) Design Criteria:
      a) UL / CASA approved.
      b) Indicating type.
   2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
      a) Milwaukee:
         (1) Model BB-SCS02 threaded ends with tamper switch one inch (25 mm) to 2 inches (50 mm).
         (2) Model BBVSCS02 Grooved ends with tamper switch 2 inches (50 mm) to 2-1/2 inch (64 mm).
      b) Nibco:
         (1) Model WD3510-8 Wafer type with valve tamper switch.
         (2) Model GD4765-8N Grooved type with valve tamper switch, 2-1/2 inches (64 mm) to 8 inches (200 mm).
      c) Tyco (Grinnell):
         (1) Model BFV-N wafer.
         (2) Model BFV-N grooved.
      d) Victaulic: Series 705W Grooved end type with internal supv. switches.
      e) Kennedy:
         (1) Model 01W wafer.
         (2) Model G300 grooved.

b. Gate Valves:
   1) Design Criteria:
      a) UL / CASA approved.
      b) Outside Screw and Yoke Type (O.S.&Y).
      c) Class 150 psi.
   2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
      a) Nibco:
         (1) T-104-0 with Threaded Ends 1/2 inch (12.7 mm) to 2 inches (50 mm).
         (2) F-637-31 Flanged Ends.
      b) Mueller: R-2360-6 Flanged Ends.
      c) Victaulic: Series 771 Grooved Ends

c. Ball Valves:
   1) Design Criteria:
      a) UL / CASA approved.
      b) Valve tamper switch.
   2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
      a) Milwaukee: BB-SCS02 with threaded ends.
      b) Nibco: KT-505 with threaded ends.
      c) Nibco: KG-505 with grooved ends.
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

- Victaulic: Series 728 with grooved or threaded ends.

**d. Swing Check Valves:**
1) 1/2 to 3 inch (13 to 75 mm) horizontal check.
   a) Design Criteria:
      - (1) Regrinding type.
      - (2) Renewable disk.
      - (3) Bronze Class 125 with threaded ends.
   b) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
      - (1) Nibco: KT-403-W.
      - (2) Victaulic: Series 712.
      - (3) Viking: G-1 Grooved ends.

2) 2 to 4 inch (50 to 100 mm) Horizontal check:
   a) Design Criteria:
      - (1) Grooved ends.
      - (2) Ductile iron body.
      - (3) Rated 300 psi (2.07 MPa).
   b) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
      - (1) Tyco (Grinnell): CV-1F Grooved ends.
      - (2) Victaulic: Series 712.
      - (3) Viking: G-1 Grooved ends.

3) 3 to 12 inch (76 to 300 mm) Horizontal check:
   a) Design Criteria:
      - (1) Bolted bonnet.
      - (2) Raised face flanges.
      - (3) Bronze mounted with ductile iron body.
      - (4) 125 lb (56.7 kg) Class A.
   b) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
      - (3) Viking: F-1 grooved and flanged.

e. Wafer Type Check Valves:
1) Design Criteria:
   a) 4 to 8 inch (100 to 300 mm) cast iron body.
   b) 175 psi (1.21 MPa) minimum working pressure.
   c) Rubber Seat.
2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
   a) Nibco: KW-900-W.
   c) Kennedy: Fig.706.

f. Grooved-End Check Valves:
1) Design Criteria:
   a) UL / CASA listed and approved to 250 psi (1.72 MPa) maximum operating pressure.
   b) 2-1/2 to 12 inch (64 to 300 mm) ductile iron body.
   c) Disc And Seat:
      - (1) 2-1/2 And 3 Inch (64 to 75 mm): Aluminum bronze disc with mounted elastomer seal and PPS (polyphenylene sulfide) coated seat.
      - (2) 4 Inch (100 mm) And Larger: Elastomer encapsulated ductile iron disc with welded in nickel seat.
      - (3) Viking: Model VK462.
2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
   b) Victaulic: Series 717.
   c) Kennedy: Fig.426.

g. Alarm Check Valves:
1) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
   a) Reliable: E with gauges and drain.
   b) Tyco (Grinnell): Model AV-1-300.
   c) Victaulic: Series 751 with gauges and drain.
   d) Viking: J-1 with gauges and drain.

h. Backflow Preventer: Make and model shown on Drawings or as required by local codes.

i. Retard Chamber:
   1) Design Criteria:
      a) Self-draining.
   2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
      a) Reliable: E-1.
      b) Victaulic: Series 752.
      c) Viking: C-1.

j. Inspector's Test Valve:
   1) Design Criteria:
      a) Bronze body with threaded or grooved ends.
      b) Combination sight glass / orifice.
   2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      a) Tyco (Grinnell): Model F350.
      b) Victaulic: Testmaster Alarm Test Module Style 720.

5. Sprinkler Heads:
   a. Concealed Pendant:
      1) Design Criteria:
         a) Adjustable cover.
         b) UL / CASA listed and approved.
         c) Coordinate concealed cover finish with Fire Sprinkler Consultant.
   2) Type One Acceptable Products:
      a) Wet Pendant, Flat Profile:
         (1) Reliable: F4FR.
         (2) Victaulic: Model 3802.
         (3) Viking: Model VK462.
         (4) Tyco (Grinnell): Model RF11.
         (5) Equal as approved by Fire Sprinkler Consultant before bidding. See Section 01 6200.
      b) Dry Pendant:
         (1) Flat Profile:
            (a) Tyco (Grinnell): DS-C.
            (b) Victaulic: V3618.
         (2) Equal as approved by Fire Sprinkler Consultant before bidding. See Section 01 6200.
   b. Horizontal Sidewall Sprinkler:
      1) Design Criteria:
         a) UL / CASA listed and approved.
         b) Recess adjustable.
         c) Where guards are required, use chrome plated sprinkler guards that are listed, that are approved by Sprinkler Manufacturer for use with head, and that are supplied by Sprinkler Manufacturer.
      2) Type One Acceptable Products:
         a) Wet System:
            (1) Reliable: F1FR.
            (2) Tyco (Grinnell): Model TY-FRB.
            (3) Victaulic: Model V2710.
            (4) Viking: VK305.
            (5) Equal as approved by Fire Sprinkler Consultant before bidding. See Section 01 6200.
      b) Dry System:
         (1) Reliable: F3QR.
         (2) Tyco (Grinnell): DS-1.
(3) Victualic: Model V3610.
(4) Viking: VK162.
(5) Equal as approved by Fire Sprinkler Consultant before bidding. See Section 01 6200.

c. Attic Sprinklers, Upright:
   1) Design Criteria:
      a) UL / CASA listed and approved.
      b) Approved for use in roof structures, combustible and non-combustible, with ceiling below.
   2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
      a) Tyco: BB, SD, or HIP.

d. Pendant Sprinklers:
   1) Design Criteria:
      a) UL / CASA listed and approved.
      b) Where guards or escutcheons are required, use chrome plated sprinkler guards and escutcheons that are listed, that are approved by Sprinkler Manufacturer for use with head, and that are supplied by Sprinkler Manufacturer.
   2) Type One Acceptable Products:
      a) Reliable: F1FR.
      b) Tyco: TY-FRB.
      c) Victualic: Model V2704.
      d) Viking: VK302.
      e) Equal as approved by Fire Sprinkler Consultant before bidding. See Section 01 6200.

e. Upright Sprinklers:
   1) Design Criteria:
      a) UL / CASA listed and approved.
   2) Type One Acceptable Products:
      a) Reliable: F1FR.
      b) Tyco: TY-FRB.
      c) Victaulic: Models V2704.
      d) Viking: VK300.
      e) Equal as approved by Fire Sprinkler Consultant before bidding. See Section 01 6200.

6. Water Flow Alarm:
   a. Electric Flow Alarm:
      1) Design Criteria:
         a) UL / CASA listed and approved.
      2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
         a) Potter Electric: Horn Strobe, SASH-120, 120VAC.
         b) System Sensor: Horn Strobe, P2RHK-120, 120 VAC.

7. Waterflow Detectors:
   a. Electrical Water Flow Switch:
      1) Design Criteria:
         a) UL / CASA listed.
         b) Switch activates with flow of 10 gpm (37.85 lpm) or more.
         c) Two single pole double throw switches.
         d) Automatic reset.
      2) Category Four Approved Products: See Section 01 6200 for definitions of Categories:
         a) Potter-Roemer: Model 6201 thru 6208.
         b) System Sensor: WFD20 thru WFD80.
         c) Viking: VSR-F.

8. Tamper Switch
   a. Weather and Tamper Resistant Switch.
      1) Design Criteria:
         a) UL / CASA listed.
         b) Mount to monitor valve and not interfere with operation.
         c) Shall operate in horizontal and vertical position.
2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
   a) Control Valves, Butterfly Valves, Post Indicator Valves:
      (1) Potter Electric: Model PCVS.
      (2) Notifier: Model PIBV2.
      (3) System Sensor: Model PIBV2.
   b) O.S. & Y Valves:
      (1) Potter Electric: Model OSYSU.
      (2) System Sensor: Model OSY2.

9. Automatic Drain Device:
   a. Design Criteria:
      1) Straight Design, 3/4 inch (19 mm).
   b. Category Four Approved Products: See Section 01 6200 for definitions of Categories:
      1) Nibco: Ball-Drip.
      2) Potter-Roemer: Figure 5982.
      3) Viking: B-1.

10. Fire Department Connection:
    a. Two-way Inlet with single clapper:
       1) Class One Quality Standards: See Section 01 6200:
          a) Round 'AUTO SPKR' identification plate, red enamel finish aluminum plate:
             (1) Croker: Fig 6766.
             (2) Potter-Roemer Fig. 5966.
       2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
          a) Rough chrome plated:
             (1) Croker: 6405-RC.
             (2) Potter-Roemer: Fig. 5710-C.
          b) Caps and Chains:
             (1) Croker: 6747 RC.
             (2) Potter-Roemer: 4625.

11. Indicating Post Valve:
    a. Design Criteria:
       1) As specified in Section 33 1119: 'Fire Suppression Water Distribution Piping'.
       2) Prefer exposed parts non-brass, for theft protection.
       3) Supervisory switch.
    b. Category Four Approved Products: See Section 01 6200 for definitions of Categories:
       1) As required by Authority Having Jurisdiction (AHJ).

12. Riser Manifold Assembly:
    a. Design Criteria:
       1) Groove x Groove Manifold Body.
       2) Water Flow Alarm Switch, VSC with Vane, UL / CASA listed and approved.
       3) 300 psi (2.07 MPa) Water Pressure Gauge.
       4) Test and Drain Valve with Manifold Drain Trim and 1/2 inch (12.7 mm) diameter test Orifice.
       5) Pressure Relief Valve, 175 psi (1.21 MPa), non-adjustable, pipe discharge to test Drain Valve.
    b. Category Four Approved Products: See Section 01 6200 for definitions of Categories:
       1) Tyco: Model 513.
       2) Victaulic: Style 747P.

2.2 ACCESSORIES

    A. Manufacturers:
       1. Manufacturer Contact List:

    B. Hangers, Rods, And Clamps:
       1. Design Criteria:

The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

2. Class One Quality Standard:
   a. Hangers and accessories shall be Anvil numbers specified or equals by B-Line by Eaton.
   b. Pipe Ring Hangers: Equal to Anvil Fig 69.
   c. Riser Clamps: Equal to Anvil Fig. 261.

C. Posted System Diagram:
   1. Provide single floor plan diagram showing wet pipe system elements.
   2. Include following information on diagram sheet:
      a. Step by step shut down procedure.
      b. Step by step system drainage procedure.
      c. Step by step start-up procedure.
      d. Step by step procedure for protection of system from freezing.
      e. Step by step procedure to follow in deactivating system for maintenance.
   3. Laminate diagram with plastic and mat or frame suitable for hanging near riser.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Acceptable Installers. See Section 01 4301:
   1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

3.2 EXAMINATION

A. Drawings:
   1. Fire Protection Drawings show general arrangement of piping. Follow as closely as actual
      building construction and work of other trades will permit. Install system so it drains.
   2. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish
      information relating to design and construction of building. These Drawings take precedence
      over Fire Protection Drawings.
   3. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and
      accessories that may be required. Investigate structural and finish conditions affecting this work
      and arrange work accordingly, providing such fittings, valves, and accessories required to meet
      conditions and to enable system to drain.

3.3 INSTALLATION

A. Connect system to flange provided under Section 33 1119: ‘Fire Suppression Utility Water Distribution
   Piping’. After installation of riser, fill annular space between pipe and slab with flexible mastic.

B. Install sprinkler systems in accordance with requirements of latest edition of NFPA 13 and as specified
   below:
   1. Provide maintenance access to equipment.
   2. Conceal sprinkler lines installed in occupied areas. In Mezzanine areas, route pipe to side or
      underneath Mezzanine walkway. Do not impede egress from Attic.
   3. Install to enable drainage of system.
      a. Install main drain from riser according to NFPA 13.
   4. Install piping system, except for dry heads, so it will not be exposed to freezing temperatures.
   5. Do not use dropped, damaged, or used sprinkler heads.
   6. Install tamper switches and flow detectors where located by Fire Sprinkler Consultant.
   7. Except for Siamese connection, install automatic ball drip device in lowest point of piping to fire
      department connection and drain to floor drain or to exterior of building.
   8. Brace and support system to meet seismic zone requirements for building site.
C. Flush system at full design flow rate for minimum five minutes. Route water to outside of building. Protect landscaping and other exterior elements from damage during flow tests.

3.4 FIELD QUALITY CONTROL

A. Field Tests:
   1. Pressure Test:
      a. Hydrostatically test system to 200 psi (1.38 MPa) minimum for two (2) hours as required by 'Contractor's Material And Testing certificate for Aboveground Piping':
         1) NFPA 13 (2010), Figure 24.1.
         2) NFPA 13 (2013), Figure 25.1.
         3) NFPA 13 (2016), Figure 25.1.
   2. Water Flow Test:
      a. Test to determine static and residual pressures and corresponding flow rate at point of connection to utility water main.
      b. Adjust water flow test data for seasonal fluctuations and future growth as recommended by Water Utility and AHJ.
      c. At point of connection to utility water main, combine inside and outside hose stream allowances.
   3. Check piping in relation to insulation envelope to be certain piping and auxiliary drains are properly enclosed inside building insulation envelope. Report unsatisfactory conditions to Fire Sprinkler Consultant.
   4. Tests shall be witnessed by Fire Sprinkler Consultant and representative of local jurisdiction over fire prevention.
   5. Fire Water Flow Test shall incorporate a minimum 10% reduction to account for seasonal fluctuations when used for fire sprinkler design purposes.
   6. The engineer of record retains the authority to approve or reject the results of the test.

3.5 CLOSE-OUT ACTIVITIES

A. Instruction of Owner:
   1. Instruction Sessions:
      a. Instruct Owner's personnel in operation and maintenance of system utilizing 'Operation And Maintenance Manual' when so doing. Minimum instruction period shall be four (4) hours.
      b. Instruction sessions shall occur after Substantial Completion inspection when system is properly working and before final payment is made.
      c. Provide Owner with latest version of NFPA 25.

B. Training:
   1. Installer required to provide FM Training from latest version of NFPA 25 with checklist and brief explanation of following inspections:
      a. Weekly Inspection.
      b. Monthly Inspection.
      c. Quarterly Inspection.
      d. Semi-Annual Inspection.
      e. Annual Inspection.

END OF SECTION
## DIVISION 22: PLUMBING

### 22 0500 COMMON WORK RESULTS FOR PLUMBING

- 22 0501 Common Plumbing Requirements
- 22 0529 Hangers and Supports for Plumbing Piping and Equipment
- 22 0553 Identification for Plumbing Pipes and Equipment
- 22 0719 Plumbing Piping Insulation

### 22 1000 PLUMBING PIPES AND PUMPS

- 22 1116 Domestic Water Piping
- 22 1119 Domestic Water Piping Specialties
- 22 1313 Facility Sewers
- 22 1319 Facility Sanitary Sewer Specialties

### 22 3000 PLUMBING EQUIPMENT

- 22 3305 Instantaneous, Tankless, Electric Domestic Water Heaters

### 22 4000 PLUMBING FIXTURES

- 22 4213 Commercial Water Closets and Urinals
- 22 4216 Commercial Lavatories and Sinks
- 22 4700 Drinking Fountains and Water Coolers

END OF TABLE OF CONTENTS
SECTION 22 0501

COMMON PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Common requirements and procedures for plumbing systems.
   2. Responsibility for proper operation of electrically powered equipment furnished under this Division.
   3. Furnish and install sealants relating to installation of systems installed under this Division.
   4. Furnish and install Firestop Penetration Systems for plumbing systems penetrations as described in Contract Documents.

B. Products Furnished But Not Installed Under This Section:
   1. Sleeves, inserts, supports, and equipment for plumbing systems installed under other Sections.

C. Related Requirements:
   1. Section 03 3111: ‘Cast-In-Place Structural Concrete’ for exterior concrete pads and bases for mechanical equipment.
   2. Section 05 0523: ‘Metal Fastening’ for quality and requirements for welding.
   3. Section 07 8400: ‘Firestopping’ for quality of penetration firestop systems to be used on Project and submittal requirements.
5. Sections Under 09 9000 Heading: 'Paints And Coatings' for painting of plumbing items requiring field painting.
6. Section 22 0548: 'Vibration And Seismic Control for Plumbing Piping and Equipment'.
7. Division 26: 'Electrical' for raceway and conduit, unless specified otherwise, and line voltage wiring.
9. Slots and openings through floors, walls, ceilings, and roofs provided under other Divisions in their respective materials.

1.2 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's catalog data for each manufactured item.
         1) Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
         2) Include name, address, and phone number of each supplier.

B. Informational Submittals:
   1. Qualification Statement:
      a. Plumbing Subcontractor:
         1) Provide Qualification documentation if requested by Architect or Owner.
      b. Installer:
         1) Provide Qualification documentation if requested by Architect or Owner.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data (Modify and add to requirements of Section 01 7800):
         1) At beginning of PLUMBING section of Operations And Maintenance Manual, provide master index showing items included:
            a) Provide name, address, and phone number of Architect, Architect's Mechanical Engineer, General Contractor, and Plumbing subcontractor.
            b) Identify maintenance instructions by using same equipment identification used in Contract Drawings. Maintenance instructions shall include:
               (1) List of plumbing equipment used indicating name, model, serial number, and nameplate data of each item together with number and name associated with each system item.
               (2) Manufacturer's maintenance instructions for each piece of plumbing equipment installed in Project. Instructions shall include name of vendor, installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance instructions.
            c) Provide operating instructions to include:
               (1) General description of fire protection system.
               (2) Step by step procedure to follow for shutting down system or putting system into operation.
      b. Warranty Documentation:
         1) Include copies of warranties required in individual Sections of Division 22.

1.3 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Perform work in accordance with applicable provisions of Plumbing Codes applicable to Project. Provide materials and labor necessary to comply with rules, regulations, and ordinances.
2. In case of differences between building codes, laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Notify Architect in writing of such differences before performing work affected by such differences.

3. Identification:
   a. Motor and equipment name plates as well as applicable UL / ULC and AGA / CGA labels shall be in place when Project is turned over to Owner.

B. Qualifications. Requirements of Section 01 4301 applies, but not limited to following:
   1. Plumbing Subcontractor:
      a. Company specializing in performing work of this section.
         1) Minimum five (5) years experience in plumbing installations.
         2) Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
      b. Upon request, submit documentation.
   2. Installer:
      a. Licensed for area of Project.
      b. Designate one (1) individual as project foremen who shall be on site at all times during installation and experienced with installation procedures required for this project.
      c. Upon request, submit documentation.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Accept valves on site in shipping containers with labeling in place.
   2. Provide temporary protective coating on cast iron and steel valves.
   3. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Storage And Handling Requirements:
   1. In addition to requirements specified in Division 01, stored material shall be readily accessible for inspection by Architect until installed.
   2. Store items subject to moisture damage in dry, heated spaces.

1.5 WARRANTY

A. Manufacturer Warranty:
   1. Provide certificates of warranty for each piece of equipment made out in favor of Owner.

B. Special Warranty:
   1. Guarantee plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.
   2. If plumbing sub-contractor with offices located more than 150 miles (240 km) from Project site is used, provide service / warranty work agreement for warranty period with local plumbing sub-contractor approved by Architect. Include copy of service / warranty agreement in warranty section of Operation And Maintenance Manual.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Components shall bear Manufacturer's name and trade name. Equipment and materials of same general type shall be of same make throughout work to provide uniform appearance, operation, and maintenance.
B. Pipe And Pipe Fittings:
   1. Weld-O-Let and Screw-O-Let fittings are acceptable.

C. Sleeves:
   1. General:
      a. Two sizes larger than bare pipe or insulation on insulated pipe.
   2. In Concrete And Masonry:
      a. Sleeves through outside walls, interior shear walls, and footings shall be schedule 80 black steel pipe with welded plate.
   3. In Framing And Suspended Floor Slabs:
      a. Standard weight galvanized iron pipe, Schedule 40 PVC, or 14 ga (2 mm) galvanized sheet metal.

D. Valves:
   1. Valves of same type shall be of same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Acceptable Installers:
   1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

3.2 EXAMINATION

A. Drawings:
   1. Plumbing Drawings show general arrangement of piping, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
   2. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Plumbing Drawings.
   3. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

B. Verification Of Conditions:
   1. Examine premises to understand conditions that may affect performance of work of this Division before submitting proposals for this work. Examine adjoining work on which plumbing work is dependent for efficiency and report work that requires correction.
   2. Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.
   3. Check that slots and openings provided under other Divisions through floors, walls, ceilings, and roofs are properly located. Perform cutting and patching caused by neglecting to coordinate with Divisions providing slots and openings at no additional cost to Owner.
   4. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.
3.3 PREPARATION

A. Changes Due To Equipment Selection:
1. Where equipment specified or otherwise approved requires different arrangement or connections from that shown in Contract Documents, submit drawings showing proposed installations.
2. If proposed changes are approved, install equipment to operate properly and in harmony with intent of Contract Documents. Make incidental changes in piping, ductwork, supports, installation, wiring, heaters, panelboards, and as otherwise necessary.
3. Provide additional motors, valves, controllers, fittings, and other equipment required for proper operation of systems resulting from selection of equipment.
4. Be responsible for proper location of rough-in and connections provided under other Divisions.

3.4 INSTALLATION

A. Interface With Other Work:
1. Furnish exact location of electrical connections and complete information on motor controls to installer of electrical system.
2. Furnish sleeves, inserts, supports, and equipment that are to be installed by others in sufficient time to be incorporated into construction as work proceeds. Locate these items and confirm that they are properly installed.

B. Cut carefully to minimize necessity for repairs to previously installed or existing work. Do not cut beams, columns, or trusses.

C. Locating Equipment:
1. Arrange pipes and equipment to permit ready access to valves, cocks, unions, traps, and to clear openings of doors and access panels.
2. Adjust locations of pipes, equipment, and fixtures to accommodate work to interferences anticipated and encountered.
3. Install plumbing work to permit removal of equipment and parts of equipment requiring periodic replacement or maintenance without damage to or interference with other parts of equipment or structure.
4. Determine exact route and location of each pipe before fabrication.
   a. Right-Of-Way:
      1) Lines that pitch shall have right-of-way over those that do not pitch. For example, plumbing drains shall normally have right-of-way.
      2) Lines whose elevations cannot be changed shall have right-of-way over lines whose elevations can be changed.
   b. Offsets, Transitions, and Changes in Direction:
      1) Make offsets, transitions, and changes in direction in pipes as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.
      2) Furnish and install all traps, air vents, sanitary vents, and devices as required to effect these offsets, transitions, and changes in direction.

D. Penetration Firestops:
1. Install Penetration Firestop System appropriate for penetration at plumbing systems penetrations through walls, ceilings, roofs, and top plates of walls.

E. Sealants:
1. Seal openings through building exterior caused by penetrations of elements of plumbing systems.
2. Furnish and install acoustical sealant to seal penetrations through acoustically insulated walls and ceilings.

F. Furnish and install complete system of piping, valved as indicated or as necessary to completely control entire apparatus:
1. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper installation of plumbing systems.

2. Arrange piping to not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings:
   a. Arrange so as to facilitate removal of tube bundles.
   b. Provide accessible flanges or ground joint unions, as applicable for type of piping specified, at connections to equipment and on bypasses.
      1) Make connections of dissimilar metals with di-electric unions.
      2) Install valves and unions ahead of traps and strainers. Provide unions on both sides of traps.
   c. Do not use reducing bushings, bull head tees, close nipples, or running couplings. Street elbows are allowed only on potable water pipe 3/4 inch (19 mm) in diameter and smaller.
   d. Install piping systems so they may be easily drained
   e. Install piping to insure noiseless circulation.
   f. Place valves and specialties to permit easy operation and access. Valves shall be regulated, packed, and glands adjusted at completion of work before final acceptance.

3. Do not install piping in shear walls.

4. Cut piping accurately to measurements established at site. Remove burr and cutting slag from pipes.

5. Work piping into place without springing or forcing. Make piping connections to pumps and other equipment without strain at piping connection. Remove bolts in flanged connections or disconnect piping to demonstrate that piping has been so connected, if requested.

6. Make changes in direction with proper fittings.

7. Expansion of Thermoplastic Pipe:
   a. Provide for expansion in every 30 feet (9 meters) of straight run.
   b. Provide 12 inch (300 mm) offset below roof line in each vent line penetrating roof.

8. Expansion of PEX Pipe: Allow for expansion and contraction of PEX pipe as recommended by Pipe Manufacturer.

G. Sleeves:
   1. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete slabs on grade.
   2. Provide sleeves around pipes passing through concrete or masonry floors, walls, partitions, or structural members. Seal sleeves with specified sealants. Follow Pipe Manufacturer’s recommendations for PEX pipe penetrations through studs and floor slabs.
   3. Sleeves through floors shall extend 1/4 inch (6 mm) above floor finish in mechanical equipment rooms above basement floor. In other rooms, sleeves shall be flush with floor.
   4. Sleeves through floors and foundation walls shall be watertight.

H. Escutcheons:
   1. Provide spring clamp plates where pipes run through walls, floors, or ceilings and are exposed in finished locations of building. Plates shall be chrome plated heavy brass of plain pattern and shall be set tight on pipe and to building surface.

3.5 REPAIR / RESTORATION

A. Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it:
   1. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown.
   2. Surface finishes shall exactly match existing finishes of same materials.

3.6 FIELD QUALITY CONTROL

A. Field Tests:

218036 / Garden City Assembly Hall 22 0501 - 6  COMMON PLUMBING REQUIREMENTS
1. Perform tests on plumbing piping systems. Furnish devices required for testing purposes.

B. Non-Conforming Work:
   1. Replace material or workmanship proven defective with sound material at no additional cost to Owner.
   2. Repeat tests on new material, if requested.

3.7 CLEANING

A. Remove dirt, grease, and other foreign matter from each length of piping before installation:
   1. After each section of piping used for movement of water or steam is installed, flush with clean water, except where specified otherwise.
   2. Arrange temporary flushing connections for each section of piping and arrange for flushing total piping system.
   3. Provide temporary cross connections and water supply for flushing and drainage and remove after completion of work.

B. Clean exposed piping, equipment, and fixtures. Remove stickers from fixtures and adjust flush valves.

3.8 CLOSEOUT ACTIVITIES

A. Instruction of Owner:
   1. Instruct building maintenance personnel and Stake Physical Facilities Representative in operation and maintenance of plumbing systems utilizing Operation And Maintenance Manual when so doing.
   2. Conduct instruction period after Substantial Completion inspection when systems are properly working and before final payment is made.

3.9 PROTECTION

A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system. Cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of system. Do not use plugs of rags, wool, cotton waste, or similar materials.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Common hanger and support requirements and procedures for plumbing systems.

B. Products Installed But Not Furnished Under This Section:
   1. Paint identification for gas piping used in HVAC equipment.

C. Related Requirements:
   1. Section 05 0523: ‘Metal Fastening’ for quality and requirements for welding.
   2. Section 07 8400: ‘Firestopping’ for quality of Penetration Firestop Systems to be used on Project and submittal requirements.
   3. Sections Under 09 9000 Heading: Painting of mechanical items requiring field painting.
   4. Slots and openings through floors, walls, ceilings, and roofs provided under other Divisions in their respective materials.
   5. Section 23 0529: ‘Hangers And Supports For HVAC Piping And Equipment’ for gas piping used with HVAC equipment.

1.2 SUBMITTALS

A. Action Submittals:
1. Product Data:
   a. Manufacturer's catalog data for each manufactured item.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
   1. Manufacturer Contact List:

B. Materials:
   1. Hangers, Rods, And Inserts
      a. Galvanized and UL approved for service intended.
      b. Support horizontal piping from hangers or on roller assemblies with channel supports, except where trapeze type hangers are explicitly shown on Drawings. Hangers shall have double nuts.
         1) Support insulated pipes 2 inches (50 mm) in diameter and smaller with adjustable swivel ring hanger with insulation protection shield. Gauge and length of shield shall be in accordance with Anvil design data.
            a) Type Two Acceptable Products:
               (1) Swivel Ring Hanger: Anvil Fig. 69.
               (2) Insulation Protection Shield: Anvil Fig. 167.
               (3) Equals by Cooper B-Line.
         2) Support insulated pipes 2-1/2 inches (64 mm) in diameter and larger with clevis hanger or roller assembly with an insulation protection shield. Gauge and length of shield shall be according to Anvil design data.
            a) Type Two Acceptable Products:
               (1) Clevis Hanger: Anvil Fig. 260.
               (2) Roller Assembly: Anvil Fig. 171.
               (3) Insulation Protection Shield: Anvil Fig. 167.
               (4) Equals by Cooper B-Line.
         3) Support uninsulated copper pipe 2 inches (50 mm) in diameter and smaller from swivel ring hanger, copper plated and otherwise fully suitable for use with copper tubing. Support non-copper uninsulated pipes from swivel ring hanger.
            a) Type Two Acceptable Products:
               (1) Swivel Ring Hanger For Copper Pipe: Anvil Fig. CT-69.
               (2) Swivel Ring Hanger For Other Pipe: Anvil Fig. 69.
               (3) Equals by Cooper B-Line.
         4) Support uninsulated copper pipe 2-1/2 inches (64 mm) in diameter and larger from clevis hanger, copper plated hangers and otherwise fully suitable for use with copper tubing. Support non-copper uninsulated pipes from clevis hanger.
            a) Type Two Acceptable Products:
               (1) Clevis Hanger For Copper Pipe: Anvil Fig. CT-65.
               (2) Clevis Hanger For Other Pipe: Anvil Fig. 260.
               (3) Equals by Cooper B-Line.
      c. Support rods for single pipe shall be in accordance with following table:

<table>
<thead>
<tr>
<th>Rod Diameter</th>
<th>Pipe Size</th>
<th>Rod Diameter</th>
<th>Pipe Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 inch</td>
<td>2 inches and smaller</td>
<td>10 mm</td>
<td>50 mm and smaller</td>
</tr>
<tr>
<td>1/2 inch</td>
<td>2-1/2 to 3-1/2 inches</td>
<td>13 mm</td>
<td>64 mm to 88 mm</td>
</tr>
<tr>
<td>5/8 inch</td>
<td>4 to 5 inches</td>
<td>16 mm</td>
<td>100 mm to 125 mm</td>
</tr>
<tr>
<td>3/4 inch</td>
<td>6 inches</td>
<td>19 mm</td>
<td>150 mm</td>
</tr>
</tbody>
</table>
### 7/8 inch 8 to 12 inches 22 mm 200 mm to 300 mm

d. Support rods for multiple pipe supported on steel angle trapeze hangers shall be in accordance with the following table:

<table>
<thead>
<tr>
<th>Rods</th>
<th>Number of Pipes per Hanger for Each Pipe Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>Diameter</td>
</tr>
<tr>
<td>2</td>
<td>3/8 Inch</td>
</tr>
<tr>
<td>2</td>
<td>1/2 Inch</td>
</tr>
<tr>
<td>2</td>
<td>5/8 Inch</td>
</tr>
<tr>
<td>2</td>
<td>5/8 Inch</td>
</tr>
<tr>
<td>2</td>
<td>5/8 Inch</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rods</th>
<th>Number of Pipes per Hanger for Each Pipe Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>Diameter</td>
</tr>
<tr>
<td>2</td>
<td>10 mm</td>
</tr>
<tr>
<td>2</td>
<td>13 mm</td>
</tr>
<tr>
<td>2</td>
<td>16 mm</td>
</tr>
<tr>
<td>2</td>
<td>19 mm</td>
</tr>
<tr>
<td>2</td>
<td>22 mm</td>
</tr>
</tbody>
</table>

1) Size trapeze angles so bending stress is less than 10,000 psi (69 MPa).

### Riser Clamps For Vertical Piping:
1) Type Two Acceptable Products:
   a) Anvil Fig. 261.
   b) Equals by Cooper B-Line.

### Concrete Inserts:
1) Individual Inserts:
   a) Suitable for special nuts size 3/8 inch (9.5 mm) through 7/8 inch (22 mm) with yoke to receive concrete reinforcing rods, and with malleable iron lugs for attaching to forms.
   b) Type Two Acceptable Products:
      (1) Anvil Fig. 282.
      (2) Equals by Cooper B-Line.

2) Continuous Inserts:
   a) Class Two Quality Standard: Equal to Unistrut P-3200 series.

### Steel Deck Bracket:
1) Class Two Quality Standard: Equal to Unistrut P1000 with clamp nut, minimum 6 inch (150 mm) length.

---

**PART 3 - EXECUTION**

### 3.1 INSTALLATION

**A. Piping:**

1. Properly support piping and make adequate provisions for expansion, contraction, slope, and anchorage.
   a. Except for underground pipe, suspend piping from roof trusses or clamp to vertical walls using Unistrut and clamps. Do not hang pipe from other pipe, equipment, or ductwork. Laying of piping on any building element is not allowed.
   b. Supports For Horizontal Piping:
      1) Support metal piping at 96 inches (2 400 mm) on center maximum for pipe 1-1/4 inches (32 mm) or larger and 72 inches (1 800 mm) on center maximum for pipe 1-1/8 inch (29 mm) or less.
2) Support thermoplastic pipe at 48 inches (1200 mm) on center maximum.
3) Support PEX pipe at 32 inches (800 mm) minimum on center.
4) Provide support at each elbow. Install additional support as required.

   c. Supports for Vertical Piping:
      1) Place riser clamps at each floor or ceiling level.
      2) Securely support clamps by structural members, which in turn are supported directly from building structure.
      3) Provide clamps as necessary to brace pipe to wall.
   d. Insulate hangers for copper pipe from piping by means of at least two layers of Scotch 33 plastic tape.

2. Gas piping Identification:
   a. Apply paint identification for gas piping used with HVAC equipment as specified in Section 23 0553.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install identification of plumbing piping and equipment as described in Contract Documents.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Materials:
   1. Labels:
      a. Equipment Identification:
         1) Black formica, with white reveal when engraved.
         2) Lettering to be 3/16 inch (5 mm) high minimum.
      b. Paint:
         1) One Coat Primer:
            1) 6-2 Quick Drying Latex Primer Sealer over fabric covers.
            2) 6-205 Metal Primer under dark color paint.
            3) 6-6 Metal Primer under light color paint.
         2) Finish Coats: Two coats 53 Line Acrylic Enamel.
c. Performance Standard: Paints specified are from Pittsburgh Paint & Glass (PPG), Pittsburgh, PA [www.pittsburghpaints.com](http://www.pittsburghpaints.com) or PPG Canada Inc, Mississauga, ON (800) 263-4350 or (905) 238-6441.

d. Type Two Acceptable Products. See Section 01 6200.
   1) Paint of equal quality from following Manufacturers may be submitted for Architect's approval before use. Maintain specified colors, shades, and contrasts.
      a) Benjamin Moore, Montvale, NJ [www.benjaminmoore.com](http://www.benjaminmoore.com) or Toronto, ON (800) 304-0304 or (416) 766-1176.
      b) ICI Dulux, Cleveland, OH or ICI Paints Canada Inc, Concord, ON [www.dulux.com](http://www.dulux.com).
      c) Sherwin Williams, Cleveland, OH [www.sherwin-williams.com](http://www.sherwin-williams.com).

PART 3 - EXECUTION

3.1 APPLICATION

A. Labels:
   1. Identify following items with specified labels fastened to equipment with screws (unless noted otherwise):
      a. Water Heaters.
   2. Engrave following data from Equipment Schedules on Drawings onto labels:
      a. Equipment mark.
      b. Room(s) served.
      c. Panel and breaker from which unit is powered.

B. Painting:
   1. Only painted legends, directional arrows, and color bands are acceptable.
   2. Locate identifying legends, directional arrows, and color bands at following points on exposed piping of each piping system:
      a. At point of entry and exit where piping goes through wall.
      b. On each riser and junction.
      c. Stenciled symbols shall be one inch high and black.

3.2 ATTACHMENTS

A. Schedules:
   1. Pipe Identification Schedule:
      a. Apply stenciled symbols as follows:

<table>
<thead>
<tr>
<th>Pipe Use</th>
<th>Abbreviation</th>
<th>Direction of Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Cold Water</td>
<td>CW</td>
<td></td>
</tr>
<tr>
<td>Domestic Hot Water</td>
<td>HW</td>
<td></td>
</tr>
<tr>
<td>Domestic Recirc Water</td>
<td>HW Recirc</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install insulation on hot and cold water lines, fittings, valves, and accessories as described in Contract Documents.
   2. Furnish and install insulation on roof drain piping as described in Contract Documents.

B. Related Requirements:
   1. Section 22 1116: ‘Domestic Water Piping’.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Manufacturers:
   1. Manufacturer Contact List:
The Church of Jesus Christ of Latter-day Saints  
Garden City Assembly Hall


B. Materials:
1. Above Grade Metal Piping:
   a. Insulation For Piping:
      1) Snap-on glass fiber or melamine foam pipe insulation, or heavy density pipe insulation with factory vapor jacket.
      2) Insulation Thickness:

      | Service Water Temperature | Pipe Sizes |
      |---------------------------|------------|
      | Up to 1-1/4 In            | 1-1/2 In   |
      | Over 2 In                 |            |
      | 170 - 180 Deg F           | One In     |
      | 140 - 160 Deg F           | 1-1/2 In   |
      | 45 - 130 Deg F            | Over 2 In  |

      | Service Water Temperature | Pipe Sizes |
      |---------------------------|------------|
      | Up to 32 mm               | 38 to 50 mm|
      | Over 50 mm                |            |
      | 77 - 82 Deg C             | 25 mm      |
      | 60 - 71 Deg C             | 25 mm      |
      | 7 - 54 Deg C              | 25 mm      |

      3) Performance Standards: Fiberglas ASJ by Owens-Corning.
      4) Type One Acceptable Manufacturers:
         a) Childers Products.
         b) Knauf.
         c) Manson.
         d) Owens-Corning.
         e) Johns-Manville.
         f) Equal as approved by Architect before bidding. See Section 01 6200.

   b. Fitting, Valve, And Accessory Covers:
      1) PVC.
      3) Type One Acceptable Manufacturers:
         a) Knauf.
         b) Speedline.
         c) Johns-Manville.
         d) Equal as approved by Architect before bidding. See Section 01 6200.

2. Below Grade Metal Piping:
   a. Insulation:
      1) 1/2 inch (13 mm) thick.
      2) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
         a) SS Tubolit by Armacell.
         b) ImcoLock by Imcoa.
         c) Nomalock or Therma-Cel by Nomaco.
   b. Joint Sealant:
      1) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
         a) Armacell 520.
         b) Nomaco K-Flex R-373.
   3. Pex Piping, Above And Below Grade:
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

a. Insulation:
   1) 1/2 inch (13 mm) thick.
   2) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
      a) SS Tubolit by Armacell.
      b) ImcoLock by Imcoa.
      c) Nomalock or Therma-Cel by Nomaco.

b. Joint Sealant:
   1) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
      a) Armacell 520.
      b) Nomaco K-Flex R-373.

4. PP-R Piping, Above And Below Grade:
a. Insulation:
   1) 1/2 inch (13 mm) thick.
   2) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
      a) SS Tubolit by Armacell.
      b) ImcoLock by Imcoa.
      c) Nomalock or Therma-Cel by Nomaco.

b. Joint Sealant:
   1) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
      a) Armacell 520.
      b) Nomaco K-Flex R-373.

5. PVC or ABS Piping, Above And Below Grade - Facility Storm Drain:
a. Insulation:
   1) 1/2 inch (13 mm) thick.
   2) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
      a) SS Tubolit by Armacell.
      b) ImcoLock by Imcoa.
      c) Nomalock or Therma-Cel by Nomaco.

b. Joint Sealant:
   1) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
      a) Armacell 520.
      b) Nomaco K-Flex R-373.

PART 3 - EXECUTION

3.1 APPLICATION

A. Above Grade Piping:
   1. Apply insulation to clean, dry piping with joints tightly butted.
   2. Install insulation in manner to facilitate removal for repairs. Place sections or blocks so least possible damage to insulation will result from inspection or repairs of piping or equipment.
   3. Piping up to 1-1/4 inch (32 mm) Diameter:
      a. Adhere 'factory applied vapor barrier jacket lap' smoothly and securely at longitudinal laps with white vapor barrier adhesive.
      b. Adhere 3 inch (76 mm) wide self-sealing butt joint strips over end joints.
   4. Piping 1-1/2 inches (38 mm) Diameter And Larger:
      a. Use broken-joint construction in application of two-layer covering.
      b. Fill cracks and depressions with insulating cement mixed to thick plastic paste.
         1) Apply by hand in several layers to make up total specified thickness.
         2) Final layer shall have smooth uniform finish before application of covering.
   5. Fittings, Valves, And Accessories:
      a. Do not apply insulation over flanged joints or victaulic couplings until piping has been brought up to operating temperature and flange bolts have been fully tightened. Insulate valves so wheel, stem, and packing nut are exposed.
b. Insulate with same type and thickness of insulation as pipe, with ends of insulation tucked snugly into throat of fitting and edges adjacent to pipe insulation tufted and tucked in.

c. Piping Up To 1-1/4 Inch (32 mm) Diameter:
   1) Cover insulation with one piece fitting cover secured by stapling or taping ends to adjacent pipe covering.
   2) Alternate Method:
      a) Insulate fittings, valves, and accessories with one inch of insulating cement and vapor seal with two 1/8 inch (3 mm) wet coats of vapor barrier mastic reinforced with glass fabric extending 2 inches (50 mm) onto adjacent insulation.

d. Piping 1-1/2 inches (38 mm) To 2 Inches (50 mm):
   1) Insulate with hydraulic setting insulating cement or equal, to thickness equal to adjoining pipe insulation.
   2) Apply final coat of fitting mastic over insulating cement.

e. Piping 2-1/2 inch (64 mm) And Larger:
   1) Insulate with segments of molded insulation securely wired in place and coated with skim coat of insulating cement.
   2) Apply fitting mastic, fitting tape and finish with final coat of fitting mastic.

6. Pipe Hangers:
   a. Do not allow pipes to come in contact with hangers.
   b. Pipe Shield:
      1) Provide schedule 40 PVC by 6 inch (150 mm) long at each clevis and/or unistrut type hanger.
      2) Provide 16 ga (1.64 mm) by 6 inch (150 mm) long galvanized shields at each pipe hanger to protect pipe insulation from crushing by clevis hanger.
      3) Provide 22 ga (0.85 mm) by 6 inch (150 mm) long galvanized shield at each pipe hanger to protect insulation from crushing by Unistrut type hanger.
   c. At Pipe Hangers:
      1) Provide rigid calcium silicate insulation (100 psi (690 kPA) compressive strength) at least 2 inches (50 mm) beyond shield.

7. Protect insulation wherever leak from valve stem or other source might drip on insulated surface, with aluminum cover or shield rolled up at edges and sufficiently large in area and of shape that dripping will not splash on surrounding insulation.

B. Below Grade Piping:
   1. Slip underground pipe insulation onto pipe and seal butt joints.
   2. Where slip-on technique is not possible, slit insulation, apply to pipe, and seal seams and joints.

END OF SECTION
**SECTION 22 1116**

**DOMESTIC WATER PIPING**

**PART 1 - GENERAL**

1.1 **SUMMARY**

A. Includes But Not Limited To:
   1. Perform excavating and backfilling required by work of this Section.
   2. Furnish and install potable water piping complete with necessary valves, connections, and accessories inside building and connect with outside utility lines 5 feet (1.50 m) from building perimeter as described in Contract Documents.

B. Related Requirements:
   1. Section 22 0501: ‘Common Piping Requirements’.
   2. Section 22 0719: ‘Plumbing Piping Insulation’.
   5. Section 33 1116: ‘Site Water Utility Distribution Piping’ for domestic water piping from 5 feet (1.50 m) from building perimeter to main.

1.2 **REFERENCES**

A. Reference Standards:
1. American National Standards Institute / American Society of Sanitary Engineers:
2. American Water Works Association:
   a. AWWA C904-16, ‘Cross-Linked Polyethylene (PEX) Pressure Pipe, 1/2 inch (12 mm) Through 3 inch (76 mm) for Water Service’.
3. ASTM International:
4. NSF International Standard:
5. NSF International Standard / American National Standards Institute:

1.3 ADMINISTRATIVE REQUIREMENTS

A. Qualifications:
   1. Manufacturer Qualifications:
      a. PP-R pipe and PP-RCT pipe:
         1) Certified by NSF International.
   2. Installers Qualifications:
      a. PP-R pipe and PP-RCT pipe:
         1) Certified by Manufacturer.

1.4 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer’s Literature:
         1) PEX pipe and PEX pipe fittings.
         2) PP-R pipe and PP-R pipe fittings.
         3) PP-RCT pipe and PP-RCT pipe fittings.
   2. Samples:
      a. PEX pipe fitting.

B. Informational Submittals:
   1. Test And Evaluation Reports:
      a. Written report of sterilization test.
1.5 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Meet NSF International Standards for materials or products that come into contact with drinking water, drinking water treatment chemicals, or both for chemical contaminants and impurities that are indirectly imparted to drinking water from products, components, and materials used in drinking water systems.
   2. California only: California Assembly Bill 1953 (AB1953) Compliant for Lead Free

1.6 WARRANTY

A. Manufacturer Warranty:
   1. Manufacturer’s Warranty covering property damage caused by defective product including renovation costs or replacement costs.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Manufacturers:
   1. Manufacturer Contact List:
      b. Acorn Controls, City of Industry, CA www.acorneng.com
      c. Cash Acme, Cullman, AL www.cashacme.com
      e. Cla-Val Company, Costa Mesa, CA or Cla-Val Canada Ltd, Beamsville, ON www.cla-val.com.
      f. Conbraco Industries Inc, Matthews, NC www.conbraco.com or Conbraco (Honeywell Ltd), Scarborough, ON (416) 293-8111.
      h. Handy & Harmon Products Div, Fairfield, CT www.handyharmon.com or Handy and Harmon of Canada Ltd, Rexdale, ON (800) 463-1465 or (416) 675-1860.
      v. Wilkins (Zurn Wilkins), Paso Robles, CA www.zurn.com.

B. Materials:
   1. Design Criteria:
      a. All drinking water products, components, and materials above and below grade used in drinking water systems must meet NSF International Standards for Lead Free.
      b. No CPVC allowed.
   2. Pipe:
      a. Copper:
DOMESTIC WATER PIPING

1. Above-Grade:
   a) Meet requirements of ASTM B88, Type L.

2. Below-Grade:
   a) Meet requirements of ASTM B88, Type K. 3/4 inch (19 mm) minimum under slabs.
   b) 2 inches (50 mm) And Smaller: Annealed soft drawn.
   c) 2-1/2 inches (64 mm) And Larger: Hard Drawn.

b. Cross-Linked Polyethylene (PEX):
   2) Copper tube size (CTS) outside dimensions and Standard Dimension Ratio (SDR) of 9.
   3) Pressure rated for 160 psi (1.10 MPa) at 73 deg F (22.8 deg C), 100 psi (0.69 MPa) at 180 deg F (82 deg C), and 80 psi (0.552 MPa) at 200 deg F (93 deg C).
   4) Marked with Manufacturer's name, design pressure and temperature ratings, and third party certification stamp for NSF-PW.
   5) Manufactured by Engel or peroxide method (PEX-A) or by silane method (PEX-B).
   6) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      a) Raupex by Rehau.
      b) Wirsbo Aquapex by Uponor.
      c) ViegaPEX by Viega.
      d) Zurn PEX by Zurn PEX.

   c. Polypropylene-Random (PP-R):
      1) Above-Grade:
         a) Meet requirements of ASTM F2389 and be certified by NSF International per ASTM F2389, NSF/ANSI 14, and NSF/ANSI 61.
         b) Aquatherm: SDR 7.4 Greenpipe faser for domestic hot water and SDR 11 greenpipe for domestic cold water. Aquatherm Lilac SDR 11 purple piping for recycled/reclaimed water systems.
         c) Nupi Americas: Clima pipe for domestic Hot water SDR-7.3 or cold water SDR 11 Nupi Niron Monolayer purple pipe for recycled/reclaimed water Systems.
      2) Below-Grade:
         a) Meet requirements of ASTM F2389 and be certified by NSF International per ASTM F2389, NSF/ANSI 14, and NSF/ANSI 61.
         b) Aquatherm: SDR 7.4 Greenpipe faser for domestic hot water and SDR 11 greenpipe for domestic cold water. Aquatherm Lilac SDR 11 purple piping for recycled/reclaimed water systems.
         c) Nupi Americas: Clima pipe for domestic Hot water SDR-7.3 or cold water SDR 11 Nupi Niron Monolayer purple pipe for recycled/reclaimed water Systems.
      3) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) Aquatherm Greenpipe, Greenpipe faser, and Lilac by Aquatherm.
         b) Nupi Americas Clima pipe, and Nupi Niron.

3. Fittings:
   a. For Copper Pipe: Wrought copper.
   b. For PEX Pipe:
      1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) Everloc by Rehau.
         b) Viega PEX Press Zero Lead Fittings with attached stainless steel sleeves or Viega PEX Press Radel-R Polymer with attached stainless steel sleeves by Viega.
         c) ProPEX fittings by Uponor including EP flow-through multiport tees.
         d) Zurn PEX XL, DZR and CR fittings.
   c. For PP-R Pipe:
      1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) Greenpipe by Aquatherm.
         b) Niron Clima by Nupi Americas.

4. Connections For Copper Pipe:
   a. Above-Grade:
      1) Sweat copper type with 95/5 or 96/4 Tin-Antimony solder, Bridgit solder, or Silvabrite 100 solder. Use only lead-free solder.
      2) Viega ProPress System
b. Below Grade:
1) Brazed using following type rods:
   a) Copper to Copper Connections:
      (1) AWS Classification BCuP-4 Copper Phosphorus (6 percent silver).
      (2) AWS Classification BCuP-5 Copper Phosphorus (15 percent silver).
   2) Copper to Brass or Copper to Steel Connections: AWS Classification BAg-5 Silver (45 percent silver).
   3) Do not use rods containing Cadmium.
   4) Brazing Flux:
      a) Approved Products:
         (1) Stay-Sílv white brazing flux by Harris Product Group.
         (2) High quality silver solder flux by Handy & Harmon.
   5) Joints under slabs acceptable only if allowed by local codes.

5. Connections For PP-R Pipe:
   a. Above-Grade:
      1) Socket-fusion, fusion-outlet, electrofusion, buttwelding, and mechanical transition fittings including threaded adapters, groove adapters, and flanges.
   b. Below-Grade:
      1) All joints shall be fusion-welded or electro-fusion welded PP-RCT except that flanges may be used when connecting to other piping systems. Mechanical fittings shall not be used below grade.
      2) Joints under slabs acceptable only if allowed by local codes.

6. Ball Valves:
   a. Use ball valves exclusively unless otherwise specified. Ball valves shall be by single manufacturer from approved list below.
   b. Valves shall be two-piece, full port for 150 psi (1.03 MPa) SWP.
      1) Operate with flow in either direction, suitable for throttling and tight shut-off.
      2) Body: Bronze, 150 psig (1.03 MPa) wsp at 350 deg F (177 deg C) and 400 psig (2.76 MPa) wog.
      3) Seat: Bubble tight at 100 psig (0.69 MPa) under water.
   c. Class One Quality Standard: Nibco T585 or S585.
      1) Equal by Conbraco 'Apollo,' Hammond, Milwaukee, or Watts.
   d. PP-R piping if used:
      1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) PP-R fusion-weld ball valves by Aquatherm.
         b) PP-RCT Fusion by Nupi Americas.

7. Combination Pressure Reducing Valve / Strainer:
   a. Integral stainless steel strainer, or separate 'Y' strainer installed upstream of pressure reducing valve.
   b. Meet ANSI/ASSE 1003 or CSA B356 requirements.
   c. Built-in thermal expansion bypass check valve.
   d. Class One Quality Standard: Watts LFU5B:
      1) Equal by Cash Acme, Cla-Val Hi Capacity, Conbraco 36C, Honeywell-Braukmann, Spence Hi Capacity, Watts, or Wilkins. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLATION
   A. Locate cold water lines a minimum of 6 inches (150 mm) from hot water line.

3.2 FIELD QUALITY CONTROL
   A. Field Tests:
1. Before pipes are covered, test systems in presence of Architect/Engineer at 125 psig (0.86 MPa) hydrostatic pressure for four (4) hours and show no leaks.
2. Disconnect equipment not suitable for 125 psig (0.86 MPa) pressure from piping system during test period.
3. PP-R Piping:
   a. Test in accordance with Manufacturer’s instructions prior to covering.
      1) Provide documentation.

### 3.3 CLEANING

A. Sterilize potable water system with solution containing 200 parts per million minimum of available chlorine and maintaining pH of 7.5 minimum. Introduce chlorinating materials into system in manner approved by Architect/Engineer. Allow sterilization solution to remain for twenty-four (24) hours and open and close valves and faucets several times during that time.

B. After sterilization, flush solution from system with clean water until residual chlorine content is less than 0.2 parts per million.

C. Water system will not be accepted until negative bacteriological test is made on water taken from system. Repeat dosing as necessary until such negative test is accomplished.

**END OF SECTION**

THIS PAGE INTENTIONALLY LEFT BLANK
SECTION 22 1119
DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install miscellaneous potable water piping specialties as described in Contract Documents.

B. Related Requirements:
   1. Section 22 0501: ‘Common Plumbing Requirements’.

1.2 REFERENCES

A. Reference Standards:
   1. NSF International Standard / American National Standards Institute:
      a. NSF/ANSI 61-2014a, 'Drinking Water System Components - Health Effects'.
      b. NSF/ANSI 372-2011, 'Drinking Water System Components - Lead Content'.
1.3 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Meet NSF International Standards for materials or products that come into contact with drinking water, drinking water treatment chemicals, or both for chemical contaminants and impurities that are indirectly imparted to drinking water from products, components, and materials used in drinking water systems.

PART 2 - PRODUCTS

2.1 ACCESSORIES

A. Manufacturers:
   1. Manufacturer Contact List:
      j. Wade (Division of Tyler Pipe), Tyler, TX  www.wadedrains.com.

B. Materials:
   1. Trap Guard Trap Seal:
      a. Design Criteria:
         1) Not required to meet NSF International Standards for Lead Free.
      b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         1) Trap Guard by Proset:
            a) Install per Manufacturer’s recommendations.
         2) Sure Seal by Sure Seal:
            a) Install per Manufacturer’s recommendation.
   2. Pressure Reducing Station:
      a. Design Criteria:
      b. Pressure Gauges:
         1) Gauges shall have following features:
            a) Cast aluminum case.
            b) Chrome plated ring.
            c) Impact resistant window.
            d) Phosphor bronze alloy steel bourdon tube.
            e) 1/2 percent scale range accuracy.
            f) 4-1/2 inch (115 mm) diameter dial face.
            g) Range 0 to 100 psig.
         2) Class One Quality Standard: 500X by H O Trerice.
            a) Equal by Ashcroft or Weiss. See Section 01 6200.
      c. Brass Gauge Cocks:
         1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
            a) 1092 by Ashcroft.
            b) 865 by H O Trerice.
   3. Water Hammer Arrestors:
      a. Design Criteria:
2) Nesting type, air pre-charged bellows with casing.
3) Bellows constructed of stabilized 18-8 stainless steel.
b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
   1) Josam: 75003.
   2) Jay R. Smith: 5020.
   3) Sioux Chief: 650 Series.
4. Double Check Valve Backflow Preventer:
a. Design Criteria:
   2) 175 psi (1207 kPa) maximum working water pressure.
   3) 180 deg F (82 deg C) maximum working water temperature.
   4) Provide ball valves.
   5) Provide inlet strainer.
b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
   1) ConBraco: DCLF4A.
   2) Watts: LF007.
   3) Zurn: 375XLVSR.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Gauges: Connect to pipe with 1/4 inch (6 mm) connections utilizing gauge cocks.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install soil, waste, and vent piping systems within building and connect with outside utility lines 5 feet (1.5 m) out from building where applicable.
   2. Perform excavation and backfill required by work of this Section.

B. Related Requirements:
   1. Sections Under 07 3000 Heading: Furnishing and installing of roof jacks and pipe flashing at roof.
   2. Section 07 8400: ‘Firestopping’ for quality of firestopping material.
   5. Section 31 2316: ‘Excavation’ for criteria for performance of excavation.
7. Section 33 3313: ‘Sanitary Utility Sewerage’ for sewage piping from 5 feet (1.5 m) out from building to main.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference: Participate in pre-installation conference specified in Section 03 3111.

1.3 REFERENCES

A. Reference Standards:

EDIT REQUIRED: Include appropriate paragraphs based on type of piping OPTION selected in PART TWO of this Section.

1. ASTM International:

2. Cast Iron Soil Pipe Institute:

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Performance:
   1. Design Criteria:
      a. Minimum size of waste piping installed under floor slab on grade shall be 2 inches (50 mm).
   2. Piping And Fittings: PVC Schedule 40 cellular core plastic pipe and pipe fittings meeting requirements of ASTM F891, joined using cement primer meeting requirements of ASTM F656 and pipe cement meeting requirements of ASTM D2564.
      a. Furnish wall cleanouts with chrome wall cover and screw.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Excavate and backfill as specified in Sections 31 2316 and 31 2323 with following additional requirements:
   1. Runs shall be as close as possible to those shown on Drawings.
   2. Excavate to required depth and grade to obtain fall required. Grade soil and waste lines within building perimeter 1/4 inch (6 mm) fall in one foot (300 mm) in direction of flow.
3. Bottom of trenches shall be hard. Tamp as required.
4. Remove debris from trench before laying of pipe.
5. Do not cut trenches near footings without consulting Architect.

B. Thermoplastic Pipe And Fittings:
1. General: Piping and joints shall be clean and installed according to Manufacturer's recommendations. Break down contaminated joints, clean seats and gaskets and reinstall.
2. Above Grade: Locate pipe hangers every 4 feet (1.2 m) on center maximum and at elbows.
3. Below Grade:
   a. Install in accordance with Manufacturer's recommendations and ASTM D2321.
   b. Stabilize unstable trench bottoms.
   c. Bed pipe true to line and grade with continuous support from firm base.
      1) Bedding depth: 4 to 6 inches (100 to 150 mm).
      2) Material and compaction to meet ASTM standard noted above.
   d. Excavate bell holes into bedding material so pipe is uniformly supported along its entire length. Blocking to grade pipe is forbidden.
   e. Trench width at top of pipe:
      1) Minimum: 18 inches (450 mm) or diameter of pipe plus 12 inches (300 mm), whichever is greater.
      2) Maximum: Outside diameter of pipe plus 24 inches (600 mm).
   f. Do not use backhoe or power equipment to assemble pipe.
   g. Initial backfill shall be 12 inches (300 mm) above top of pipe with material specified in referenced ASTM standard.
   h. Minimum cover over top of pipe not under building slab:
      1) 36 inches (900 mm) before wheel loading.
      2) 48 inches (1200 mm) before compaction.

C. Install piping so cleanouts may be installed as follows:
1. At every 135 degrees of accumulative change in direction for horizontal lines.
2. Every 100 feet (30 meters) of horizontal run.
3. Extend piping to accessible surface. Do not install piping so cleanouts must be installed in carpeted floors. In such locations, configure piping so wall type cleanouts may be used.

D. Each fixture and appliance discharging water into sanitary sewer or building sewer lines shall have seal trap in connection with complete venting system so gasses pass freely to atmosphere with no pressure or siphon condition on water seal.

E. Vent entire waste system to atmosphere. Join lines together in fewest practicable numbers before projecting above roof. Set back vent lines so they will not pierce roof near edge or valley. Vent line terminations shall be:
1. 6 inches (150 mm) minimum above roof and 12 inches (300 mm) minimum from any vertical surface.
2. Same size as vent pipe.
3. In areas where minimum design temperature is below 0 deg F (minus 18 deg C) or where frost or snow closure may be possible:
   a. Vent line terminations shall be same size as vent pipe, except no smaller than 2 inches (50 mm) in diameter.
   b. Vents shall terminate 10 inches (250 mm) minimum above roof or higher if required by local codes.

F. Furnish and install firestopping at penetrations of fire-rated structures as required under Sections 07 8400 and 22 0501.

G. If test Tees are used for testing, plug Tees so wall finish can be installed. Do not leave as exposed cleanouts.
3.2 FIELD QUALITY CONTROL

A. Field Tests:
   1. Conduct tests for leaks and defective work. Notify Architect before testing.
   2. Thermoplastic Pipe System:
      a. Before backfilling and compacting of trenches, Fill waste and vent system with water to roof level or 10 feet (3 meters) minimum, and show no leaks for two hours. Correct leaks and defective work.
      b. After backfilling and compacting of trenches is complete but before placing floor slab, re-test as specified above. Uncover pipe and correct leaks and defective work. Re-backfill and compact and re-test.

END OF SECTION
SECTION 22 1319

FACILITY SANITARY SEWER SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under this Section as described in Contract Documents.

B. Related Requirements:
   1. Section 09 3013: 'Ceramic Tile' for floor drains in ceramic tile floors.
   2. Section 22 0501: ‘Common Plumbing Requirements’.
2.1 SYSTEMS

A. Manufacturers:
   1. Manufacturer Contact List:
         1) Contact Information:
            a) All Areas except Idaho and Utah: Rick Ensley (253) 564-0624,
               rick@thesureseal.com.
            b) Idaho and Utah Areas: Mark Evans, phone (801) 748-1222,
               mark@franklinjames.com.
      g. Wade Div Tyler Pipe, Tyler, TX  www.wadedrains.com.
      h. Watts Drainage, Spindale, NC  www.watts.com or Watts Industries, Burlington, ON, Canada
      i. Zurn Industries, LLC, Erie PA  www.zurn.com or Zurn Industries Ltd, Mississauga, ON
         (905) 795-8844.

B. Performance:
   1. Design Criteria:
      a. All materials NOT required to be low lead compliant.

C. Components:
   1. Drains And Drain Accessories:
      a. Floor Drain FD-1:
         1) Approved types with deep seal trap and chrome plated strainer.
         2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
            a) Josam: 30000-50-Z-5A.
            b) J. R. Smith: 2010-A.
            c) Mifab: F-1100-C.
            d) Sioux Chief: 832.
            e) Wade: 1100.
            f) Watts: FD-200-A.
            g) Zurn: Z-415.

D. Accessories:
   1. Drain Accessories:
      a. Floor Drains:
         1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
            a) Trap guard by Proset Systems. Provide model number to match floor drain.
            b) Trap seal by Sureseal. Provide model number to match floor drain.

PART 3 - EXECUTION: Not Used

END OF SECTION
SECTION 22 3305
INSTANTANEOUS, TANKLESS ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install electric water heater as specified in Contract Documents.

B. Related Requirements:
   1. Section 22 0501: 'Common Plumbing Requirements'.
   2. Section 22 1116: 'Domestic Water Piping'.

1.2 REFERENCES

A. Reference Standard:
   1. NSF International Standard / American National Standards Institute:
      a. NSF/ANSI 61-2015, 'Drinking Water System Components - Health Effects'.
      b. NSF/ANSI 372-2016, 'Drinking Water System Components - Lead Content'.
1.3 SUBMITTALS

A. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Maintenance and operational instructions.
      b. Warranty Documentation:
         1) Final, executed copy of Warranty.
      c. Record Documentation:
         1) Manufacturers documentation:
            a) Manufacturer's literature or cut sheet.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Meet NSF International Standards for materials or products that come in contact with drinking
      water, drinking water treatment chemicals, or both for chemical contaminants and impurities that
      are indirectly imparted to drinking water from products, components, and materials used in
      drinking water systems.

1.5 WARRANTY

A. Special Warranty:
   1. Ten-year non-prorated warranty on water heater body and element assembly against failure due
      to leaks and a one-year warranty of the field serviceable element.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
   1. Manufacturer Contact List:
      b. A O Smith Water Products Co, Ashland City, TN  www.hotwater.com or A O Smith Ltd,
         Stratford, ON (800) 265-8520 or (519) 271-5800.
      e. Rheem / Ruud Water Heater Div Rheem Manufacturing, Atlanta, GA  www.rheem.com or
         Rheem Canada Inc Water Heater Division, Hamilton, ON (800) 268-6966 or (905) 527-9194.

B. Materials:
   1. Design Criteria:
      a. All (wetted) drinking water products, components, and materials used in drinking water
         systems must meet NSF International Standards for Lead Free.
      b. All water heaters require 'Tempered Water Temperature Control' (mixing valves) as specified
         in Section 22 1116.
   2. 0 Gallon (0 Liter):
      a. UL listed.
      b. 110-240 V, single phase.
      c. Thermostatic control with adjustable setting.
PART 3 - EXECUTION

3.1 INSTALLATION
   A. Install per manufacture's requirements and per local codes.

3.2 ADJUSTING
   A. Set discharge water temperature at 110 deg F.

END OF SECTION
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

SECTION 22 4213
COMMERCIAL WATER CLOSETS AND URINALS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install plumbing fixtures as described in Contract Documents.

B. Related Requirements:
   1. Section 07 9213: ‘Elastomeric Joint Sealants’ for sealants used between fixtures and other substrates.
   2. Section 22 0501: ‘Common Plumbing Requirements’.
   3. Section 22 1116: ‘Domestic Water Piping’.

1.2 REFERENCES

A. Definitions:
   1. Maximum Performance (MaP): Toilet testing that rates toilet efficiency and flush performance by measuring number of grams of solid waste (soybean paste and toilet paper) that a toilet can flush
and remove completely from fixture in single flush represented as a scale or score. 1000 grams is highest score possible (www.map-testing.com).

B. Reference Standards:
   1. American Society of Mechanical Engineers / CSA Group (Canadian Standards Association):

1.3 SUBMITTALS

A. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operation and Maintenance Data:
         1) Sensor Operated operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
   1. Manufacturer Contact List:
      g. Delta Faucet Co, Indianapolis, IN  www.deltafaucet.com or Delta Faucet Canada, London, ON (519) 659-3626.
      p. Olsonite Corp, Newnan, GA  www.olsonite.net or Olsonite Co Ltd, Tilbury, ON (519) 682-1240.
      v. Zurn Industries, LLC, Erie PA  www.zurn.com or Zurn Industries Ltd, Mississauga, ON (905) 795-8844.

B. Performance:
   1. Design Criteria:
      a. Meet or exceed ASME A112.19.2/CSA B45.1 for Vitreous China Plumbing Fixtures.
      b. Interior exposed pipe, valves, and fixture trim, including trim behind custom casework doors, shall be chrome plated.
      c. All materials NOT required to be low lead compliant.
d. Do not use toilets with effective flush volume of less than 1.28 gallons (4.8 liters).

C. Materials:

1. Water Closets:
   a. Floor Mounted With Tank:
      1) Standard Fixture:
         a) Water usage of 1.6 gallons (6 liters) per flush.
         b) MaP Score of 1000 grams.
         c) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
            (1) American Standard: Cadet 3 Elongated 215CA.004.
            (2) Gerber: Avalanche AV-21-812.
            (3) Kohler: Wellworth K-3978.
            (4) Toto: 'Drake' CST744S.
      2) Handicap Accessible Fixture:
         a) Water usage of 1.6 gallons (6 liters) per flush.
         b) 18 inch (450 mm) maximum rim height.
         c) MaP Score of 1000 grams.
         d) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
            (1) American Standard: Cadet 3 Right Height Elongated 215AA.004.
            (2) Gerber: Avalanche AV-21-818.
            (3) Kohler: Highline K-3979.
            (4) Toto: 'ADA Drake' CST744SL.

   2. Water Closet Accessories:
      a. Seats:
         1) Provide split front type with check hinge.
      2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) Standard And Handicap Accessible Fixtures:
            (1) American Standard: 5905.100SS.
            (2) Bemis: 1655SSC.
            (3) Beneke: 527 SS.
            (4) Church: 9500SSC.
            (5) Kohler: K-4731-C.
            (6) Olsonite: 95SSC.
            (7) Toto SC534.
      b. Supply Pipe And Stop:
         1) Provide chrome plated quarter-turn brass ball valve, 12 inch (300 mm) braided stainless steel riser, and chrome-plated steel flange.
      2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) McGuire: BV2166CC.
         b) Zurn: Z8804.

3. Urinals:
   a. HEU (High-Efficiency Urinal) - Standard Fixture:
      1) Water usage of 0.5 gallons (1.9 liters) per flush.
      2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) American Standard: Washbrook FloWise 6590.001.
         b) Gerber: Monitor 27-730.
         c) Kohler: Bardon K-4904-ET.
         d) Sloan SU-1009.
         e) Toto: UT447E.

4. Urinal Accessories:
   a. Carrier / Support:
      1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) Josam.
         b) Jay R. Smith.
         c) Mifab.
         d) Wade.
e) Zurn.

b. Flush Valve:
   1) HEU (High-Efficiency Urinal) - Standard:
      a) Proximity sensor type with battery.
      b) Low flow, 0.5 gallon (1.9 liters) per flush maximum.
      c) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         (1) American Standard 6063.051.
         (2) Delany: PL 1451-0.5.
         (3) Delta: 81T231BTA factory set to 0.5 gallons per flush.
         (4) Moen: 8315.
         (5) Sloan: 8186-0.5.
         (6) Zurn: ZER6003AV-EWS with maintenance override button.

c. Flush Valve Filter:
   1) Required in following flush valves:
      a) Sloan.
      b) Zurn.

   2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      a) SFDG1 'Dirt Grabber' by South Fork Manufacturing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install each fixture with separate vent line. Do not circuit vent.

B. Ensure provisions are made for proper support of fixtures and that rough-in piping is accurately set and protected from movement and damage.
   1. Seal wall-mounted fixtures around edges to wall with sealant specified in Section 07 9213 'Elastomeric Joint Sealants'.
   2. Attach wall-hung fixtures to carriers.
   3. Support fixture hanger or arm free of finished wall.

C. Adjust flush valves for proper flow.

D. Provide each individual fixture supply with accessible chrome-plated stop valve with hand wheel.

E. Urinals: Install with accessible stop or control valve in each branch supply line.

F. Mounting:
   1. Urinals:
      a. Standard: 24 inches (610 mm) from floor to bottom lip.
      b. Handicap Accessible: 17 inches (432 mm) maximum from floor to bottom lip.

G. Water Closets:
   1. Floor or Wall Fixtures:
      a. Make fixture connections with approved brand of cast iron flange, soldered or caulked securely to waste pipe. Make joints between fixtures and flanges tight with approved fixture setting compound or gaskets. Caulk between fixtures with sealant specified in Section 07 9213. Point edges.

H. Flush Valve Filters:
   1. Install in Sloan and Zurn only flush valves.
   2. Install after water lines have been flushed out, but before turning water into flush valve.
3.2 CLEANING

A. Polish chrome finish at completion of Project.

END OF SECTION
<table>
<thead>
<tr>
<th>Section</th>
<th>22 4216</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>COMMERCIAL LAVATORIES AND SINKS</td>
</tr>
</tbody>
</table>

218036 / Garden City Assembly Hall

22 4216 - 1

COMMERCIAL LAVATORIES AND SINKS
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install plumbing fixtures as described in Contract Documents.

B. Related Requirements:
   1. Section 07 9213: 'Elastomeric Joint Sealants' for sealants used between fixtures and other substrates.
   2. Section 22 0501: 'Common Plumbing Requirements'.
   3. Section 22 1116: 'Domestic Water Piping'.

1.2 REFERENCES

A. Reference Standard:
   1. American National Standards Institute / International Code Council:
   2. American Society of Mechanical Engineers / Canadian Standards Association (CSA Group):
      a. ASME A112.18.1-2012/CSA B125.1-12, 'Plumbing Supply Fittings'.
      b. ASME A112.19.1-2013/CSA B45.2-13, 'Enamelled cast iron and enamelled steel plumbing fixtures'.
      c. ASME A112.19.3-2008/CSA B45.4-08 (R2013), 'Stainless steel plumbing fixtures'.
   3. NSF International Standard / American National Standards Institute:
      a. NSF/ANSI 61-2015, 'Drinking Water System Components - Health Effects'.
      b. NSF/ANSI 372-2016, 'Drinking Water System Components - Lead Content'.

1.3 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Meet NSF International Standards for materials or products that come into contact with drinking water, drinking water treatment chemicals, or both for chemical contaminants and impurities that are indirectly imparted to drinking water from products, components, and materials used in drinking water systems.

1.4 SUBMITTALS

A. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Warranty Documentation:
         1) Final, executed copy of Warranty.

1.5 WARRANTY

A. Manufacturer Warranty:
   1. Manufacturer's standard Warranty against material or Manufacturing defects.
PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
   1. Manufacturer Contact List:
      e. Dearborn Brass, Tyler, TX  www.dearbornbrass.com.
      f. Delta Faucet Co, Indianapolis, IN  www.deltafaucet.com or Delta Faucet Canada, London, ON  (519) 659-3626.
      bb. Zurn Commercial Brass, Sanford, NC  www.zurn.com or Zurn Industries Ltd, Mississauga, ON  (905) 795-8844.

B. Performance:
   1. Design Criteria:
      a. Interior exposed pipe, valves, and fixture trim, including trim behind custom casework doors, shall be chrome plated.
      b. Faucets and other fixture fittings shall conform to requirements of ASME A112.18.1/CSA B125.1.
      c. Lavatories shall conform to requirements of:
         1) Enamelled cast iron and enamelled steel fixtures.
            a) ASME A112.19.1/CSA B45.2.
            b) CSA B45.2/ASME A112.19.1.
         2) Stainless steel plumbing fixtures:
            a) ASME A112.19.3/CSA B45.4.
            b) CSA B45.4/ASME A112.19.3.

C. Components:
   1. Lavatories And Fittings:
      a. Standard and Handicap Accessible Self Supporting Lavatories:
1) Size: 20 by 18 inches (500 by 450 mm) nominal.

2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
   a) American Standard: Lucern 0355.012.
   b) Kohler: Greenwich K-2032.

3) Carrier / Support:
   a) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      (1) Josam: 17100.
      (2) Jay R. Smith: 0700.
      (3) Mifab: MC-41.
      (4) Wade: 520-M36.

b. Lavatory Fittings:
   1) Faucet and Grid Strainer For Standard Sinks:
      a) Design Criteria:
         (1) Meet NSF International Standards for Lead Free.
      b) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         (2) Chicago: 802CP with 327XCP.
         (3) Delta: 2529HDF.
         (4) Gerber: C4-44-412.
         (6) Moen: 8215 with 14750 grid strainer.
         (7) Speakman: SC 3072.
         (8) T & S: B-0890 with B-0899 Grid Strainer.
         (9) Zum: Z81104 with McGuire 155A Grid Strainer.
   2) Faucet and Grid Strainer For Handicap Accessible Sinks:
      a) Design Criteria:
         (1) Meet NSF International Standards for Lead Free.
      b) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         (2) Chicago: 802-317CP with K7715 strainer.
         (3) Delta: 2529HDF.
         (4) Gerber: CO-44-412.
         (6) Moen: 8215 with 14750 grid strainer.
         (7) Speakman: SC 3074.
         (8) T & S: B-0890 with B-0899 Grid Strainer.
         (9) Zum: Z81104 with McGuire 155A grid strainer.
   3) Flow Control Fitting:
      a) Design Criteria:
         (1) Meet NSF International Standards for Lead Free.
      b) Accessories:
         (1) Provide vandal-proof type in place of aerator. Flow shall be 0.5 gpm.
      c) Category Four Approved Product. See Section 01 6200 for definitions of Categories:
         (1) Omni L-200 Series by Chronomite Laboratories.
   4) Supply pipes with stops:
      a) Design Criteria:
         (1) Meet NSF International Standards for Lead Free.
      b) Accessories:
         (1) Provide chrome plated quarter-turn brass ball valve, 12 inches (305 mm) long braided stainless steel riser, and chrome-plated steel flange.
      c) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
(1) McGuire: BV2165CC.
(2) Zurn: Z8804 LRQ-PC.
5) Trap:
   a) Description:
      (1) 17 gauge (1.4 mm) tube 'P' trap, chrome plated.
   b) Design Criteria:
      (1) Not required to meet NSF International Standards for Lead Free.
   c) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      (1) Dearborn.
      (2) Engineered Brass Company (EBC).
      (3) Keeney Manufacturing.
      (4) McGuire.
      (5) Zurn.
6) Safety Covers for Handicap Accessible Lavatories:
   a) Description:
      (1) Provide protection on water supply pipes and on trap.
   b) Design Criteria:
      (1) Not required to meet NSF International Standards for Lead Free.
   c) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      (1) Trapwrap by Brocar Products Inc.
      (2) Pro Wrap by McGuire Products.
      (3) Lav Guard 2 by TrueBro.
      (4) Pro Extreme by Plumberex.
2. Stainless Steel Sinks And Fittings:
   a. Design Criteria:
      1) Not required to meet NSF International Standards for Lead Free.
      2) Self-rimming, 18 gauge (1.2 mm) stainless steel, satin finish.
   b. Double Compartment Sinks:
      1) Design Criteria:
         a) Not required to meet NSF International Standards for Lead Free.
      2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) Elkay: LR 3319.
         b) Just: DL-1933-A-GR.
         c) Kindred: LBT 4408P-1.
   c. Single Compartment Sink:
      1) Description:
         a) Size: 22 by 19.5 inches (559 mm by 495 mm) nominal.
      2) Design Criteria:
         a) Not required to meet NSF International Standards for Lead Free.
      3) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) Elkay: LR-2219.
         b) Just: SL-1921-AG-R.
         c) Kindred: LBS 4008P-1.
   d. Stainless Steel Sink Fittings:
      1) Gooseneck Faucets for Compartment Serving Area Sinks:
         a) Design Criteria:
            (1) Meet NSF International Standards for Lead Free.
         b) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
            (1) Moen: 8227. (swivel).
            (2) Speakman: SC-5724. (swivel).
      2) Faucets for Sacrament Preparation Room Sink:
         a) Design Criteria:
            (1) Meet NSF International Standards for Lead Free.
         b) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
(1) American Standard: Gooseneck Swivel Spout 7100.241H.
(2) Chicago: 350-ABCP.
(4) Gerber: C4-44-701.
(5) Kohler: K-7895-C.
(6) Moen: 8103.
(7) Speakman: SC-7112.
(8) T & S: 0305-01.
(9) Zurn: Z-825B1FC.

3) Faucets for Serving Area Sinks:
   a) Design Criteria:
      (1) Meet NSF International Standards for Lead Free.
   b) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      (1) Moen: 8227. (swivel).
      (2) Speakman: SC-5724. (swivel).

4) Supply pipes with stops:
   a) Design Criteria:
      (1) Meet NSF International Standards for Lead Free.
   b) Accessories:
      (1) Provide chrome plated quarter-turn brass ball valve, 12 inches (300 mm) long braided stainless steel riser, and chrome-plated steel flange.
   c) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      (1) McGuire: BV2165CC.
      (2) Zurn: Z8804 LRQ-PC.

5) Flow Control Fitting:
   a) Design Criteria:
      (1) Meet NSF International Standards for Lead Free.
   b) Accessories:
      (1) Provide vandal-proof type in place of aerator. Flow shall be 1.5 gpm.
   c) Category Four Approved Product. See Section 01 6200 for definitions of Categories:
      (1) Omni A-200 Series by Chronomite Laboratories.

6) Waste For Standard Stainless Steel Sinks:
   a) Design Criteria:
      (1) Not required to meet NSF International Standards for Lead Free.
   b) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      (2) Kindred: 1130.
      (3) Kohler: K8801.
      (4) McGuire: 151.
      (5) Zurn Z-8740-PC.

7) Waste For Sacrament Preparation Room Sink:
   a) Design Criteria:
      (1) Not required to meet NSF International Standards for Lead Free.
   b) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      (1) Elkay: LK18.
      (2) Just: J-35FS.
      (3) Kohler: K8807G.
      (4) McGuire: 152.
      (5) Zurn Z-8739-PC.

8) Trap:
   a) Description:
      (1) 17 gauge (1.4 mm) tube 'P' trap, chrome plated.
   b) Design Criteria:
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

(1) Not required to meet NSF International Standards for Lead Free.
c) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
   (1) Dearborn.
   (2) Engineered Brass Company (EBC).
   (3) Keeney Manufacturing.
   (4) McGuire: MCT150075NCZN.
   (5) Zurn.

3. Miscellaneous Sinks And Fittings:
   a. Service Sink:
      1) Description:
         a) Floor Type, enameled cast iron, 28 inches (711 mm) square with vinyl coated rim guard or 24 inches (610 mm) square with Stainless Steel rim guard.
      2) Design Criteria:
         a) Not required to meet NSF International Standards for Lead Free.
      3) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) American Standard: Florwell Enameled Cast Iron 7741.000 with vinyl rim guard 7745.811.
         b) CECO: 871.
         c) Kohler: Whitby K-6710.
         d) Zurn: 5850.
   b) Supply:
      (1) Mounting height of 42 inches (1 050 mm).
      (2) Provide 48 inch (1 200 mm) hose and clamp unless spout is threaded.
   c) Drain and Strainer:
      (1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         (a) American Standard: Grid strainer 7721.038.
         (b) Kohler: K-9146, 3 inch IPS.
      d) Trap: Cast iron, PVC, or ABS to match piping.

PART 3 - EXECUTION

3.1 INSTALLATION

   A. Install each fixture with separate vent line. Do not circuit vent.

   B. Ensure provisions are made for proper support of fixtures and that rough-in piping is accurately set and protected from movement and damage.
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

C. Seal wall-mounted fixtures around edges to wall and counter top fixtures to countertop with sealant specified in Section 07 9213.

D. Unless otherwise noted, provide each individual fixture supply with chrome-plated stop valve with hand wheel.

E. Install fixtures with accessible stop or control valve in each hot and cold water branch supply line.


G. Install Safety Covers on all under sink / lavatories with exposed water supply pipes and traps.

H. Install Handicap Accessible Lavatories as per ADA height mounting requirements.

3.2 CLEANING

A. Polish chrome finish at completion of Project.

END OF SECTION
THIS PAGE INTENTIONALLY LEFT BLANK
SECTION 22 4700
DRINKING FOUNTAINS AND WATER COOLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install drinking water cooling system units as described in Contract Documents.

B. Related Requirements:
   1. Section 22 0501: ‘Common Plumbing Requirements’.
   2. Section 22 1116: ‘Domestic Water Piping’.

1.2 REFERENCES

A. Reference Standard:
   1. American National Standards Institute / International Code Council:
   2. NSF International Standard / American National Standards Institute:
      a. Bottle Filling Station:
      b. Water Cooler:
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

2) NSF/ANSI 372-2016, 'Drinking Water System Components - Lead Content'.
3. Underwriters Laboratories (UL):
   a. UL 399: 'Drinking-Water Coolers'.

1.3 SUBMITTALS
A. Closeout Submittals:
   1. Warranty Documentation:
      a. Provide Manufacturer Warranty.

1.4 QUALITY ASSURANCE
A. Regulatory Agency Sustainability Approvals:
   1. Handicap Accessible Products to meet ANSI/ICC A117 Accessible requirements.
   2. Meet NSF International Standards for materials or products that come into contact with drinking water, drinking water treatment chemicals, or both for chemical contaminants and impurities that are indirectly imparted to drinking water from products, components, and materials used in drinking water systems.

1.5 WARRANTY
A. Manufacturer standard limited warranty on refrigeration system of unit.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS
A. Manufacturers:
   1. Manufacturer Contact List:
B. Design Criteria:
   1. All drinking water products, components, and materials above and below grade used in drinking water systems must meet NSF International Standards for Lead Free.
   2. Interior exposed pipe, valves, and fixture trim shall be chrome plated.
C. Materials:
   1. Handicap Accessible Bi-Level Cooler:
      a. Design Criteria:
         1) Vandal proof operating bar on front and both sides.
         2) 8 GPH (30.3 LPH) water at 50 deg F (10 deg C) water cooled from 80°F (26.7°C) inlet water and 90°F (32.2°C) ambient per ASHRAE testing.
         3) 115-120 V, 60 Hz, single phase.
         4) Flexible bubbler.
         5) Build-In strainer.
         6) Meets state and federal requirements for both children or adults as defined by the Americans with Disabilities Act.
      b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         1) Elkay: Model EZSTL8LC.
         2) Halsey Taylor: Model HAC8FSBL-Q-ADA.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fixtures with accessible stop or control valve.

B. Mounting:
   1. General:
      a. Coordinate location of fountain with location and height of electrical outlet to ensure
         concealment of outlet by fountain.
      b. Anchor bottom of fountain to wall.
      c. Install 3/8 inch (9.5 mm) IPS union connection and Chicago No. 441 stop to building supply
         line.
      d. Install 1-1/4 inch (32 mm) IPS slip cast brass 'P' trap. Install trap so it is concealed.
   2. Accessible Drinking Fountains:
      a. Spout outlets of wheelchair accessible drinking fountains shall be 36 inches (915 mm)
         maximum above floor.
      b. Spout outlets of drinking fountains for standing persons shall be 38 inches (965 mm) and 43
         inches (1090 mm) maximum above floor.

3.2 CLEANING

A. Polish chrome finish at completion of Project.

END OF SECTION
# Division 23: Heating, Ventilating, and Air-Conditioning

## Division 23: Heating, Ventilating, and Air-Conditioning

### 23 0500 Common Work Results for HVAC
- **23 0501** Common HVAC Requirements
- **23 0529** Hangers and Supports for HVAC Piping and Equipment
- **23 0553** Identification for HVAC Piping and Equipment
- **23 0713** Duct Insulation
- **23 0719** HVAC Piping Insulation
- **23 0933** Electric and Electronic Control System for HVAC

### 23 1000 Facility Fuel Systems
- **23 1123** Facility Gas Piping

### 23 2000 HVAC Piping and Pumps
- **23 2300** Refrigerant Piping
- **23 2600** Condensate Drain Piping

### 23 3000 HVAC Air Distribution
- **23 3001** Common Duct Requirements
- **23 3114** Low-Pressure Metal Ducts
- **23 3300** Air Duct Accessories
- **23 3346** Flexible Ducts
- **23 3401** Exhaust Fans
- **23 3713** Diffusers, Registers, and Grilles
- **23 3714** Louvers and Vents

### 23 4000 HVAC Air Cleaning Devices
- **23 4100** Air Filters

### 23 5000 Central Heating Equipment
- **23 5134** Flues
- **23 5417** Gas-Fired Furnaces

### 23 6000 Central Cooling Equipment
- **23 6214** Compressor Units: Air Conditioning (5 Ton or Less)

### 23 8000 Decentralized HVAC Equipment
- **23 8216** Air Coils: DX
- **23 8333** Electric Radiant Heaters

---

**End of Table of Contents**
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Common requirements and procedures for HVAC systems.
   2. Responsibility for proper operation of electrically powered equipment furnished under this Division.
   3. Interface with Testing And Balancing Agency.
   4. Furnish and install sealants relating to installation of systems installed under this Division.
   5. Furnish and install Firestop Penetration Systems for HVAC system penetrations as described in Contract Documents.
   6. Furnish and install sound, vibration, and seismic control elements.

B. Products Furnished But Not Installed Under This Section:
   1. Sleeves, inserts, and equipment for mechanical systems installed under other Sections.

C. Related Requirements:
   1. Section 03 3111: ‘Cast-In-Place Structural Concrete’ for exterior concrete pads and bases for mechanical equipment.
   2. Section 05 0523: ‘Metal Fastening’ for quality and requirements for welding.
3. Section 07 8400: 'Firestopping’ for quality of Penetration Firestop Systems to be used on Project and submittal requirements.
4. Section 07 9213: 'Elastomeric Joint Sealant' for quality of sealants used at building exterior.
5. Section 07 9219: 'Acoustical Joint Sealants' for quality of acoustical sealants.
6. Sections Under 09 9000 Heading: Painting of mechanical items requiring field painting.
7. Section 26 2913: 'Enclosed Controllers' for magnetic starters and thermal protective devices (heaters) not factory mounted integral part of mechanical equipment.
8. Division 26: Raceway and conduit, unless specified otherwise, line voltage wiring, outlets, and disconnect switches.
9. Slots and openings through floors, walls, ceilings, and roofs provided under other Divisions in their respective materials.

1.2 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's catalog data for each manufactured item.
         1) Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
         2) Include name, address, and phone number of each supplier.
      2. Shop Drawings:
         a. Schematic control diagrams for each separate fan system, heating system, control panel, etc. Each diagram shall show locations of all control and operational components and devices. Mark correct operating settings for each control device on these diagrams.
         b. Diagram for electrical control system showing wiring of related electrical control items such as firestats, fuses, interlocks, electrical switches, and relays. Include drawings showing electrical power requirements and connection locations.
         c. Drawing of each temperature control panel identifying components in panels and their function.
         d. Other shop drawings required by Division 23 trade Sections.

B. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data (Modify and add to requirements of Section 01 7800):
         1) At beginning of HVAC section of Operations And Maintenance Manual, provide master index showing items included.
            a) Provide name, address, and phone number of Architect, Architect's Mechanical Engineer, General Contractor, and HVAC, Sheet Metal, Refrigeration, and Temperature Control subcontractors.
            b) Identify maintenance instructions by using same equipment identification used in Contract Drawings. Maintenance instructions shall include:
               (1) List of HVAC equipment used indicating name, model, serial number, and nameplate data of each item together with number and name associated with each system item.
               (2) Manufacturer's maintenance instructions for each piece of HVAC equipment installed in Project. Instructions shall include name of vendor, installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance and lubrication instructions.
               (3) Summary list of mechanical equipment requiring lubrication showing name of equipment, location, and type and frequency of lubrication.
               (4) Manual for Honeywell T7350 thermostat published by Honeywell.
            c) Provide operating instructions to include:
               (1) General description of each HVAC system.
(2) Step by step procedure to follow in putting each piece of HVAC equipment into operation.

(3) Provide diagrams for electrical control system showing wiring of items such as smoke detectors, fuses, interlocks, electrical switches, and relays.

b. Warranty Documentation:
   1) Include copies of warranties required in individual Sections of Division 23.

c. Record Documentation:
   1) Manufacturers documentation:
      a) Copies of approved shop drawings.

1.3 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Perform work in accordance with applicable provisions of Gas Ordinances applicable to Project. Provide materials and labor necessary to comply with rules, regulations, and ordinances.
   2. In case of differences between building codes, laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Notify Architect in writing of such differences before performing work affected by such differences.
   3. Identification:
      a. Motor and equipment name plates as well as applicable UL / ULC and AGA / CGA labels shall be in place when Project is turned over to Owner.

B. Qualifications: Requirements of Section 01 4301 applies, but not limited to following:
   1. Company:
      a. Company specializing in performing work of this section.
         1) Minimum five (5) years experience in HVAC installations.
         2) Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
      b. Upon request, submit documentation.
   2. Installer:
      a. Licensed for area of Project.
      b. Designate one (1) individual as project foremen who shall be on site at all times during installation and experienced with installation procedures required for this project.
      c. Upon request, submit documentation.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Accept valves on site in shipping containers with labeling in place.

B. Storage And Handling Requirements:
   1. In addition to requirements specified in Division 01:
      a. Stored material shall be readily accessible for inspection by Architect until installed.
      b. Store items subject to moisture damage, such as controls, in dry, heated spaces.
      c. Provide temporary protective coating on cast iron and steel valves.
      d. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
   2. Protect bearings during installation. Thoroughly grease steel shafts to prevent corrosion.

1.5 WARRANTY

A. Manufacturer Warranty:
   1. Provide certificates of warranty for each piece of equipment made out in favor of Owner. Clearly record 'start-up' date of each piece of equipment on certificate.
B. Special Warranty:
1. Guarantee HVAC systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.
2. If HVAC sub-contractor with offices located more than 150 miles (240 km) from Project site is used, provide service / warranty work agreement for warranty period with local HVAC sub-contractor approved by Architect. Include copy of service / warranty agreement in warranty section of Operation And Maintenance Manual.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Components shall bear Manufacturer’s name and trade name. Equipment and materials of same general type shall be of same make throughout work to provide uniform appearance, operation, and maintenance.

B. Pipe And Pipe Fittings:
1. Use domestic made pipe and pipe fittings on Project.
2. Weld-O-Let and Screw-O-Let fittings are acceptable.

C. Sleeves:
1. In Framing: Standard weight galvanized iron pipe, Schedule 40 PVC, or 14 ga (2 mm) galvanized sheet metal two sizes larger than bare pipe or insulation on insulated pipe.
2. In Concrete And Masonry: Sleeves through outside walls, interior shear walls, and footings shall be schedule 80 black steel pipe with welded plate.

D. Valves:
1. Valves of same type shall be of same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Acceptable Installers:
1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

3.2 EXAMINATION

A. Drawings:
1. HVAC Drawings show general arrangement of piping, ductwork, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
2. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over HVAC Drawings.
3. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

B. Verification Of Conditions:
1. Examine premises to understand conditions that may affect performance of work of this Division before submitting proposals for this work. Examine adjoining work on which mechanical work is dependent for efficiency and report work that requires correction.

2. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

3. Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.

4. Check that slots and openings provided under other Divisions through floors, walls, ceilings, and roofs are properly located. Perform cutting and patching caused by neglecting to coordinate with Divisions providing slots and openings at no additional cost to Owner.

3.3 PREPARATION

A. Changes Due To Equipment Selection:
   1. Where equipment specified or otherwise approved requires different arrangement or connections from that shown in Contract Documents, submit drawings, if requested by Architect, showing proposed installations.
   2. If proposed changes are approved, install equipment to operate properly and in harmony with intent of Contract Documents. Make incidental changes in piping, ductwork, supports, installation, wiring, heaters, panelboards, and as otherwise necessary.
   3. Provide any additional motors, valves, controllers, fittings, and other additional equipment required for proper operation of system resulting from selection of equipment.
   4. Be responsible for the proper location of roughing-in and connections provided under other Divisions.

3.4 INSTALLATION

A. Interface With Other Work:
   1. Furnish sleeves, inserts, supports, and equipment that are to be installed by others in sufficient time to be incorporated into construction as work proceeds. Locate these items and see they are properly installed.
   2. Electrical: Furnish exact location of electrical connections and complete information on motor controls to installer of electrical system.
   3. Testing And Balancing:
      a. Put HVAC systems into full operation and continue their operation during each working day of testing and balancing.
      b. Make changes in pulleys, belts, fan speeds, and dampers or add dampers as required for correct balance as recommended by Testing And Balancing Agency and at no additional cost to Owner.

B. Cut carefully to minimize necessity for repairs to previously installed or existing work. Do not cut beams, columns, or trusses.

C. Locating Equipment:
   1. Arrange pipes, ducts, and equipment to permit ready access to valves, cocks, unions, traps, filters, starters, motors, control components, and to clear openings of doors and access panels.
   2. Adjust locations of pipes, ducts, switches, panels, and equipment to accommodate work to interferences anticipated and encountered.
   3. Install HVAC work to permit removal of equipment and parts of equipment requiring periodic replacement or maintenance without damage to or interference with other parts of equipment or structure.
   4. Determine exact route and location of each pipe and duct before fabrication.
a. Right-Of-Way:
   1) Lines that pitch shall have right-of-way over those that do not pitch. For example, steam, steam condensate, and drains shall normally have right-of-way.
   2) Lines whose elevations cannot be changed shall have right-of-way over lines whose elevations can be changed.

b. Offsets, Transitions, and Changes in Direction:
   1) Make offsets, transitions, and changes in direction in pipes and ducts as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.
   2) Furnish and install all traps, air vents, sanitary vents, and devices as required to effect these offsets, transitions, and changes in direction.

D. Piping:
   1. Furnish and install complete system of piping, valved as indicated or as necessary to completely control entire apparatus.
      a. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper erection of systems of piping in every respect.
      b. Arrange piping to not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings.
         1) Arrange so as to facilitate removal of tube bundles.
         2) Provide accessible flanges or ground joint unions, as applicable for type of piping specified, at connections to equipment and on bypasses.
            a) Make connections of dissimilar metals with di-electric unions.
            b) Install valves and unions ahead of traps and strainers. Provide unions on both sides of traps.
      3) Do not use reducing bushings, street elbows, bull head tees, close nipples, or running couplings.
      4) Install piping systems so they may be easily drained. Provide drain valves at low points and manual air vents at high points in hot water heating and cooling water piping.
      5) Install piping to insure noiseless circulation.
      6) Place valves and specialties to permit easy operation and access. Valves shall be regulated, packed, and glands adjusted at completion of work before final acceptance.
      c. Do not install piping in shear walls.
   2. Properly make adequate provisions for expansion, contraction, slope, and anchorage.
      a. Cut piping accurately for fabrication to measurements established at site. Remove burr and cutting slag from pipes.
      b. Work piping into place without springing or forcing. Make piping connections to pumps and other equipment without strain at piping connection. Remove bolts in flanged connections or disconnect piping to demonstrate that piping has been so connected, if requested.
      c. Make changes in direction with proper fittings.
      d. Expansion of Thermoplastic Pipe:
         1) Provide for expansion in every 30 feet (9 meters) of straight run.
         2) Provide 12 inch (300 mm) offset below roof line in each vent line penetrating roof.
   3. Provide sleeves around pipes passing through concrete or masonry floors, walls, partitions, or structural members. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete floors on grade. Seal sleeves with specified sealants.
      a. Sleeves through floors shall extend 1/4 inch (6 mm) above floor finish in mechanical equipment rooms above basement floor. In other rooms, sleeves shall be flush with floor.
      b. Sleeves through floors and foundation walls shall be watertight.
   4. Provide spring clamp plates (escutcheons) where pipes run through walls, floors, or ceilings and are exposed in finished locations of building. Plates shall be chrome plated heavy brass of plain pattern and shall be set tight on pipe and to building surface.
   5. Remove dirt, grease, and other foreign matter from each length of piping before installation.
      a. After each section of piping used for movement of water or steam is installed, flush with clean water, except where specified otherwise.
      b. Arrange temporary flushing connections for each section of piping and arrange for flushing total piping system.
c. Provide temporary cross connections and water supply for flushing and drainage and remove after completion of work.

E. Penetration Firestops: Install Penetration Firestop System appropriate for penetration at HVAC system penetrations through walls, ceilings, roofs, and top plates of walls.

F. Sealants:
1. Seal openings through building exterior caused by penetrations of elements of HVAC systems.
2. Furnish and install acoustical sealant to seal penetrations through acoustically insulated walls and ceilings.

3.5 REPAIR / RESTORATION

A. Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.
1. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown.
2. Surface finishes shall exactly match existing finishes of same materials.

3.6 FIELD QUALITY CONTROL

A. Field Tests:
1. Perform tests on HVAC piping systems. Furnish devices required for testing purposes.

B. Non-Conforming Work:
1. Replace material or workmanship proven defective with sound material at no additional cost to Owner.
2. Repeat tests on new material, if requested.

3.7 SYSTEM START-UP

A. Off-Season Start-up:
1. If Substantial Completion inspection occurs during heating season, schedule spring start-up of cooling systems. If inspection occurs during cooling season, schedule autumn start-up for heating systems.
2. Notify Owner seven days minimum before scheduled start-up.
3. Time will be allowed to completely service, test, check, and off-season start systems. During allowed time, train Owner's representatives in operation and maintenance of system.
4. At end of off-season start-up, furnish Owner with letter confirming that above work has been satisfactorily completed.

B. Preparations that are to be completed before start up and operation include, but are not limited to, following:
1. Dry out electric motors and other equipment to develop and properly maintain constant insulation resistance.
2. Make adjustments to insure that:
   a. Equipment alignments and clearances are adjusted to allowable tolerances.
   b. Nuts and bolts and other types of anchors and fasteners are properly and securely fastened.
   c. Packed, gasketed, and other types of joints are properly made up and are tight and free from leakage.
   d. Miscellaneous alignings, tightenings, and adjusting are completed so systems are tight and free from leakage and equipment performs as intended.
3. Motors and accessories are completely operable.
4. Inspect and test electrical circuitry, connections, and voltages to be properly connected and free from shorts.
5. Adjust drives for proper alignment and tension.
6. Make certain filters in equipment for moving air are new and of specified type.
7. Properly lubricate and run-in bearings in accordance with Manufacturer's directions and recommendations.

3.8 CLEANING

A. Clean exposed piping, ductwork, and equipment.

B. No more than one week before Final Inspection, flush out bearings and clean other lubricated surfaces with flushing oil. Provide best quality and grade of lubricant specified by Equipment Manufacturer.

C. Replace filters in equipment for moving air with new filters of specified type no more than one week before Final Inspection.

3.9 CLOSEOUT ACTIVITIES

A. Instruction Of Owner:
   1. Instruct building maintenance personnel and Stake Physical Facilities Representative in operation and maintenance of mechanical systems utilizing Operation And Maintenance Manual when so doing:
      a. Minimum Instruction Periods:
         1) HVAC: Eight (8) hours.
         2) Temperature Control: Six (6) hours.
         3) Refrigeration: Four (4) hours.
      b. Conduct instruction periods after Substantial Completion inspection when systems are properly working and before final payment is made. None of these instructional periods shall overlap another.

3.10 PROTECTION

A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system. Cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of system. Do not use plugs of rags, wool, cotton waste, or similar materials.

B. Do not operate pieces of equipment used for moving supply air without proper air filters installed properly in system.

C. After start-up, continue necessary lubrication and be responsible for damage to bearings while equipment is being operated up to Substantial Completion.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Common hanger and support requirements and procedures for HVAC systems.

B. Related Requirements:
   1. Section 05 0523: 'Metal Fastening' for quality and requirements for welding.
   2. Section 07 8400: 'Firestopping' for quality of Penetration Firestop Systems to be used on Project
      and submittal requirements.
   3. Slots and openings through floors, walls, ceilings, and roofs provided under other Divisions in
      their respective materials.

C. Products Installed But Not Furnished Under This Section:
   1. Stencils and band colors of gas piping used in HVAC equipment.

D. Related Requirements:
   1. Section 09 9124: 'Interior Painted Metal' for providing field painting of identification of piping used
      with HVAC equipment.
   2. Section 23 0553: 'Identification For HVAC Piping And Equipment' for HVAC piping and
      equipment identification signage requirements.
   3. Sections Under 09 9000 Heading: Painting of mechanical items requiring field painting.
1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Section 09 9124 to coordinate with Section 23 0529 for location of identification of HVAC piping and equipment to be field painted and Section 23 0553 for painting requirements of HVAC piping and equipment.
   2. Section 23 0529 to coordinate with Section 23 0553 for stencil and band color locations and identification requirements of HVAC piping and equipment for field application.

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's catalog data for each manufactured item.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
   1. Class Two Quality Standard Approved Manufacturers. See Section 01 6200:

B. Performance:
   1. Design Criteria:
      a. Support rods for single pipe shall be in accordance with following table:
         | Rod Diameter | Pipe Size   | Rod Diameter | Pipe Size   |
         | 3/8 inch     | 2 inches and smaller | 10 mm | 50 mm and smaller |
         | 1/2 inch     | 2-1/2 to 3-1/2 inches | 13 mm | 63 mm to 88 mm |
         | 5/8 inch     | 4 to 5 inches | 16 mm | 100 mm to 125 mm |
         | 3/4 inch     | 6 inches | 19 mm | 150 mm |
         | 7/8 inch     | 8 to 12 inches | 22 mm | 200 mm to 300 mm |
      b. Support rods for multiple pipes supported on steel angle trapeze hangers shall be in accordance with following table:
         | Rods | Number of Pipes per Hanger for Each Pipe Size |
         | No.  | Diameter | 2 Inch | 2.5 Inch | 3 Inch | 4 Inch | 5 Inch | 6 Inch | 8 Inch |
         | 2    | 3/8 Inch | 0  | 0  | 0  | 0  | 0  | 0  |
         | 2    | 1/2 Inch | Three | Three | Two | 0  | 0  | 0  | 0  |
         | 2    | 5/8 Inch | Six | Four | Three | Two | 0  | 0  | 0  |
         | 2    | 5/8 Inch | Nine | Seven | Five | Three | Two | Two | Two |
         | 2    | 5/8 Inch | Twelve | Nine | Seven | Five | Three | Two | Two |

| Rods | Number of Pipes per Hanger for Each Pipe Size |
| No.  | Diameter | 50mm | 63mm | 75mm | 100mm | 125mm | 150mm | 200mm |
| 2    | 10 mm    | Two | 0 | 0 | 0 | 0 | 0 | 0 |
| 2    | 13 mm    | Three | Three | Two | 0 | 0 | 0 | 0 |
| 2    | 16 mm    | Six | Four | Three | Two | 0 | 0 | 0 |
| 2    | 19 mm    | Nine | Seven | Five | Three | Two | Two | Two |
| 2    | 22 mm    | Twelve | Nine | Seven | Five | Three | Two | Two |
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

1) Size trapeze angles so bending stress is less than 10,000 psi (69 Mpa).

C. Materials:
   1. Hangers, Rods, Channels, Attachments, And Inserts:
      a. Galvanized and UL approved for service intended.
      b. Support horizontal piping from clevis hangers or on roller assemblies with channel supports, except where trapeze type hangers are explicitly shown on Drawings. Hangers shall have double nuts.
      c. Class Two Quality Standards:
         1) Support insulated pipes with clevis hanger equal to Anvil Fig 260 or roller assembly equal to Anvil Fig 171 with an insulation protection shield equal to Anvil Fig 167. Gauge and length of shield shall be in accordance with Anvil design data.
         2) Except uninsulated copper pipes, support uninsulated pipes from clevis hanger equal to Anvil Fig 260. Support uninsulated copper pipe from hanger equal to Anvil Fig CT-65 copper plated hangers and otherwise fully suitable for use with copper tubing.
      d. Riser Clamps For Vertical Piping:
         1) Class Two Quality Standard: Anvil Figure 261.
      e. Furnace / Fan Coil Support Channel:
         1) Class One Quality Standard: Unistrut P1000.
         2) Acceptable Manufacturers: Hilti, Thomas & Betts.
         3) Equal as approved by Architect before installation. See Section 01 6200.
      f. Swivel Attachment:
         1) Class One Quality Standard: Unistrut EM3127.
         2) Acceptable Manufacturers: Hilti, Thomas & Betts.
         3) Equal as approved by Architect before installation. See Section 01 6200.

EXECUTION

2.2 INSTALLATION

A. Piping:
   1. Properly support piping and make adequate provisions for expansion, contraction, slope, and anchorage.
      a. Except for underground pipe, suspend piping from roof trusses or clamp to vertical walls using support channels and clamps. Do not hang pipe from other pipe, equipment, or ductwork. Laying of piping on any building element is not allowed.
      b. Supports For Horizontal Piping:
         1) Support metal piping at 96 inches (2 400) mm on center maximum for pipe 1-1/4 inches (32 mm) or larger and 72 inches (1 800 mm) on center maximum for pipe 1-1/8 inch (28 mm) or less.
         2) Support thermoplastic pipe at 48 inches (1 200 mm) on center maximum.
         3) Provide support at each elbow. Install additional support as required.
      c. Supports for Vertical Piping:
         1) Place riser clamps at each floor or ceiling level.
         2) Securely support clamps by structural members, which in turn are supported directly from building structure.
         3) Provide clamps as necessary to brace pipe to wall.
      d. Insulate hangers for copper pipe from piping by means of at least two layers of Scotch 33 plastic tape.
      e. Expansion of Thermoplastic Pipe:
         1) Provide for expansion in every 30 feet (9 meters) of straight run.
         2) Provide 12 inch (300 mm) offset below roof line in each vent line penetrating roof.

END OF SECTION
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall
SECTION 23 0553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But not Installed Under This Section:
   1. Identification of HVAC piping and equipment as described in Contract Documents including:
      a. Paint identification for gas piping used in HVAC equipment.
      b. Stencils and band colors for gas piping used in HVAC equipment.

B. Related Requirements:
   1. Section 09 9124: ‘Interior Painted Metal’ for providing field painting of identification of piping used with HVAC equipment.
   2. Section 22 0529: ‘Hangers And Supports For Plumbing’ for field installation of pipe stencils and band colors for identification for piping used with HVAC equipment.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Description:
   1. Abbreviations for Pipe Stencils and Equipment Identification and Band Colors for Pipe Identification:
      a. Apply stenciled symbols and continuous painting as follows:
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

<table>
<thead>
<tr>
<th>Pipe Type</th>
<th>Pipe Color</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas</td>
<td>Yellow</td>
<td>GAS</td>
</tr>
</tbody>
</table>

B. Materials:
1. Category Four Approved Products and Manufacturers. See Section 01 6200 for definitions of Categories:
   a. Products listed in edition of MPI Approved Product List current at time of bidding and later are approved, providing they meet VOC requirements in force where Project is located.
2. Description:
   a. Ferrous Metal:
      1) New Surfaces: Use MPI(a) INT 5.1B Waterborne Light Industrial Finish system.
3. Performance Requirements:
   a. New Surfaces: MPI Premium Grade finish requirements.
   b. Maintain specified colors, shades, and contrasts.
4. Paint (one coat):
   a. Primer:
      1) Ferrous Metal:
         a) MPI 107, ‘Primer, Rust-Inhibitive, Water Based’.
         (1) Color: white.
      b. Finish Coat (two coats):
         1) Ferrous Metal:
            a) MPI 153, ‘Light Industrial Coating, Interior, Water Based, Semi-Gloss (MPI Gloss Level 5)’.
5. Labels:
   a. Equipment Identification:
      1) Black formica, with white reveal when engraved.
      2) Lettering to be 3/16 inch (5 mm) high minimum.

PART 3 - EXECUTION

3.1 APPLICATION

A. Labels:
1. Identify following items with specified labels fastened to equipment with screws (unless noted otherwise):
   a. Thermostats and control panels in mechanical spaces (attach label to wall directly above or below thermostats).
   b. Furnaces.
   c. Condensing units.
   d. Unit Heaters.
   e. Accessible exhaust fans.

B. Painting:
1. New Surfaces:
   a. Remove rust spots by sanding and immediately spot prime. If all traces of rust cannot be removed, apply rust blocker recommended by Paint Manufacturer before applying full primer coat.
2. Leave equipment in like-new appearance.
3. Only painted legends, directional arrows, and color bands are acceptable.
4. Locate identifying legends, directional arrows, and color bands at following points on exposed piping of each piping system:
   a. Adjacent to each item of equipment.
   b. At point of entry and exit where piping goes through wall.
   c. On each riser and junction.
   d. Every 25 feet (7.620 m) on long continuous lines.
   e. Stenciled symbols shall be one inch (25 mm) high and black.
SECTION 23 0713
DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install thermal wrap duct insulation as described in Contract Documents.

B. Related Requirements:
   1. Section 23 3114: 'Low-Pressure Metal Ducts'.
   2. Section 23 3300: 'Acoustic Duct Accessories' for duct liner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer Contact List:
   3. Knauf Fiber Glass, Shelbyville, IN  www.knauffiberglass.com or Toronto, ON  (416) 593-4322.
2.2 MATERIALS

A. Thermal Wrap Duct Insulation:
   1. 1-1/2 inch (38 mm) or 3 inch (76 mm) thick fiberglass with factory-laminated, reinforced aluminum foil scrim kraft facing and density of 0.75 lb / per cu ft (12 kg / per cu m).
   2. Thermal Conductivity: 0.27 BTU in/HR SF deg F at 75 deg F (24 deg C) maximum.
   3. Type One Acceptable Products:
      a. Type 75 standard duct insulation by Certainteed St Gobain.
      b. Microlite FSK by Johns-Manville.
      c. Duct Wrap FSK by Knauf Fiber Glass.
      d. Alley Wrap FSK by Manson Insulation Inc.
      e. FRK by Owens-Corning.
      f. Equal as approved by Architect before bidding. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Thermal Wrap Duct Insulation:
   1. Install insulation as follows:
      a. Within Building Insulation Envelope:
         1) 1-1/2 inches (38 mm) thick on rectangular outside air ducts and combustion air ducts.
         2) 1-1/2 inches (38 mm) thick on all round ducts.
      b. Outside Building Insulation Envelope:
         1) 3 inch (76 mm) thick on round supply and return air ducts.
         2) 1-1/2 inch (38 mm) thick on rectangular, acoustically lined, supply and return air ducts.
   2. Wrap insulation tightly on ductwork with circumferential joints butted and longitudinal joints overlapped minimum 2 inches (50 mm).
      a. Do not compress insulation except in areas of structural interference. Minimum thickness at corners shall be one inch (25 mm) thick.
      b. Remove insulation from lap before stapling.
      c. Staple seams at approximately 16 inches (400 mm) on center with outward clenching staples.
      d. Seal seams with foil vapor barrier tape or vapor barrier mastic. Seal penetrations of facing to provide vapor tight system.

B. Insulate outside of ceiling diffusers, diffuser drops, and duct silencers same as ductwork.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install insulation on above ground refrigerant piping and fittings as described in
      Contract Documents.

B. Related Requirements:
   1. Section 23 0501: ‘General HVAC Requirements’.
   2. Section 23 2300: ‘Refrigerant Piping’.

1.2 DELIVERY, STORAGE, AND HANDLING

A. Storage And Handling Requirements:
   1. Keep materials and work dry and free from damage.
   2. Replace wet or damaged materials at no additional cost to Owner.
PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
   1. Manufacturer Contact List:
      h. Owens-Corning, Toledo, OH www.owenscorning.com or Owens-Corning Canada Inc, Willowdale, ON (416) 733-1600.

B. Materials:
   1. Refrigeration Piping System:
      a. Thickness:

         | Pipe Size, Outside Diameter | Insulation Thickness |
         |-----------------------------|---------------------|
         | One inch and smaller        | 1/2 Inch            |
         | 1-1/8 to 2 inch             | 3/4 Inch            |

         1) One inch sheet for fittings as recommended by Manufacturer.
         2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
            a) AP Armaflex 25/50 by Armacell.
            b) Nitrolite by Nitron Industries. White only for exterior.
            c) Nomaco K-Flex.
      b. Joint Sealer:
         1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
            a) Armacell 520 by Armacell.
            b) Namaco K-Flex R-373.
      c. Insulation Tape:
         1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
            a) Armaflex AP Insul Tape by Armacell.
            b) FT182 Tape by Nitron Industries.
            c) Elastomeric Foamtape by Nomac K-Flex.
      d. Exterior Finish:
         1) For application to non-white, exterior insulation.
         2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
            a) WB Armaflex Finish by Armacell.
            b) R-374 Protective Coating by Nomaco K-Flex.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before application of insulating materials, brush clean surfaces to be insulated and make free from rust, scale, grease, dirt, moisture, and any other deleterious materials.
B. Use drop cloths over equipment and structure to prevent adhesives and other materials spotting the work.

### 3.2 INSTALLATION

**A. Refrigeration System Piping System:**

1. **General:**
   a. Install insulation in snug contact with pipe.
      1) Insulate flexible pipe connectors.
      2) Insulate thermal expansion valves with insulating tape.
      3) Insulate fittings with sheet insulation and as recommended by Manufacturer.
   b. Slip insulation on tubing before tubing sections and fittings are assembled keeping slitting of insulation to a minimum.
   c. Do not install insulation on lines through clamp assembly of pipe support. Butt insulation up against sides of clamp assembly.
   d. Stagger joints on layered insulation. Seal joints in insulation.
   e. Install insulation exposed outside building so ‘slit’ joint seams are placed on bottom of pipe.
   f. Paint exterior exposed, non-white insulation with two coats of specified exterior finish.

2. **System Requirements:**
   a. Condensing Units: Install insulation on above ground refrigerant suction piping and fittings, including thermal bulb, from thermal expansion valve.

### 3.3 FIELD QUALITY CONTROL

**A. Non-Conforming Work:**

1. Method of installing insulation shall be subject to approval of Architect. Sloppy or unworkmanlike installations are not acceptable.

### 3.4 CLEANING

**A.** Leave premises thoroughly clean and free from insulating debris.

### 3.5 PROTECTION

**A.** Protect insulation wherever leak from valve stem or other source might drip on insulated surface, with aluminum cover or shield rolled up at edges and sufficiently large in area and of shape that dripping will not splash on surrounding insulation.

**END OF SECTION**
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install automatic temperature control system as described in Contract Documents.
   2. Furnish and install conductors and make connections to control devices, motors, and associated equipment.
   3. Assist in air test and balance procedure.

B. Related Requirements:
   1. Section 01 4546: Duct testing, adjusting, and balancing of ductwork.
   2. Section 23 0501: Common HVAC Requirements.
   4. Division 26:
      a. Furnishing and installing of raceway, conduit, and junction boxes, including pull wires, for temperature control system except as noted above.
      b. Power wiring to magnetic starters, disconnect switches, and motors.
      c. Motor starters and disconnect switches, unless integral with packaged equipment.
1.2 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Installer to provide product literature or cut sheets for all products specified in Project.
      b. Installer to provide questions of control equipment locations to Mechanical Engineer prior to
         installation.

B. Informational Submittals:
   1. Certificates:
      a. Installer must provide ‘Certificate of Sponsorship’ signed from Approved Distributor with bid
         confirming Installer sponsorship.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Leave with O&M Manual specified in Section 23 0501.
      b. Record Documentation:
         1) Installer’s ‘Certificate of Sponsorship’.

1.3 QUALITY ASSURANCE

A. Qualifications:  Requirements of Section 01 4301 applies, but is not limited to the following:
   1. Installer:
      a. Before bidding, obtain sponsorship from a local, Approved Distributor specified under PART
         2 PRODUCTS of this specification.  Initial requirements for sponsorship are:
         1) Receive LCBS Connect product training from Approved Distributor.
         2) Installer to provide Distributor sponsorship by submitting ‘Certificate of Sponsorship’ as
            Informational Submittal with bid.  Certificate available as Attachment in this
            Specification.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Manufacturers:
   1. Manufacturer Contact List:
         1) Primary Contact:  Chris Brinkerhoff, (801) 550-3344, chris.brinkerhoff@honeywell.com.
      d. ICCA Firex, Carol Stream, IL  www.icca.invensys.com.
      e. Insul_Guard, Salt Lake City, UT:
         1) Primary Contact:  Dan Craner, (801) 518-3733, insul_guard@comcast.net.
      g. Zimmerman Technologies, Renton, WA:
         1) Primary Contact:  Tracy Zimmerman, (425) 255-1906, zimmtech@yahoo.com.

B. Distributors:  Obtain LCBS Connect control devices, RP panels, sensors, actuators and other control
   equipment from following Sponsoring Approved Distributors.  See Section 01 4301:
   1. Colorado:
      a. CD Jones: (303) 501-0411 Mbisbee@cdjones.com Mark Bisbee.
   2. Idaho:
      a. Control Equipment Co: (800) 452-1457 rhowe@controlequiputah.com Ray Howe.
C. Performance:

1. Design Criteria:
   a. Honeywell LCBS Connect control system with cloud based gateway:
      1) General Requirements:
         a) Controls multistage equipment, dehumidification and ventilation with 2 wire connection to controller interface location in occupied space.
         b) Adjustable backlight to controller interface module from 15%-100% en after 30 seconds of setting adjustments.
         c) System controllers can be programmed from the interface module or from the cloud service.
         d) LCBS Connect controller utilizes echelon communication network with the controller located near the mechanical equipment and the system interface located in the occupied space.
         e) System shall control outdoor ventilation air based upon system occupancy of electric / electronic actuation of dampers.
         f) CO2 sensors will open ventilation dampers only when CO2 exceeds 1200 ppm with ppm monitored by cloud service.
         g) LCBS Connect devices access via internet Chrome browser via gateway.
         h) Wired room temperature sensors may be added as specified.
      2) System Requirements:
         a) Up to 3 Heat/2 Cool Heat Pumps; Up to 3 Heat/2 Cool Conventional Systems.
         b) Tri-Lingual display (Selectable for English, Spanish, or French).
         c) 18 to 30 Vac.
         d) 50 Hz; 60 Hz.
         e) System switch to include Auto changeover for Heat-Cool.
         f) 7-Day Programming.
         g) 365-Day Event Scheduling.
         h) Display Security Lockout options.
         i) Minimum/ Maximum Temperature Range Stops.
         j) Configurable over-ride option.
         k) Remote Access via internet.
         l) Dehumidification setting range 40 to 80% RH.
   b. Honeywell TrueZone panel enabled device(s):
      1) General Requirements: Zone Panel:
         a) Work in conjunction with LCBS Connect.
         b) Control multiple zones on single fan coil unit (gas fired furnace with air conditioning or air handling unit with heat pump).
         c) Keypad programming & checkout.
         d) Work with conventional, heat pump or dual fuel applications.
         e) Push wire terminals.
         f) Add-a-zone panel expandable.
      2) Dampers:
         a) Bypass damper installs in any orientation at any angle.
         b) Bypass damper provides constant pressure relief regardless of blower speed.
         c) Bypass damper provides visual damper percentage open.
d) Zone damper powered by 24VAC circuit from zone panel.
e) Zone damper adjustable range stops for consistent bleed setting.
f) Zone damper LED indicator lights (red closed, green open/ 3 wire applications).
g) Zone damper terminals have push terminals.

D. Components:
1. Controller, Wall Module:
   a. Controller and Display Kit:
      1) Category Four Approved Product. See Section 01 6200 for definitions of Categories:
         a) Part Number Honeywell YCRL6438SR1000 consisting of following:
            (1) Unitary Controller: Honeywell CRL6438SR1000
            (2) Wall Module: Honeywell TS120
         b) Wall Cover Plate: Honeywell. 50002883-001.
         c) Discharge Air / Return Air Sensors: Honeywell C7041B2005 20k ohms.
         e) Indoor Air Sensor:
            (1) Sylk bus network; Honeywell TR40.
   f) Averaging sensor:
      (1) Sylk bus network; Honeywell TR40.
   b. Internet Gateway Module(s): One (1) module per thirty (30) controllers.
      1) Category Four Approved Product. See Section 01 6200 for definitions of Categories:
         a) LCBS Connect Gateway Module: Honeywell LGW1000.
2. Zone panel and Components:
   a. Zone Panel: Honeywell TrueZone HZ322.
   b. Zone Panel: Honeywell TrueZone HZ432.
   c. Zone Expansion Controller X4, where required: Honeywell TAZ-4.
   d. Zone Panel Transformer: AT175F1023.
   e. Zone Discharge Air Temperature Sensor: Honeywell C7735A1000.
   f. Zone Damper(s): Honeywell ARD (damper size) TZ round damper.
   g. Zone Damper(s): Honeywell ZD (damper size) TZ rectangular damper.
   h. Zone Bypass Damper: Honeywell CPRD (damper size).
3. Sealant Compound:
   a. Description:
      1) Non hardening waterproof, vapor proof, self-adhesive for hot or cold application for
         sealing conduit openings against drafts, dust moisture and noise.
   b. Category Four Approved Product. See Section 01 6200 for definitions of Categories:
      1) Duct Seal Compound No. DS-130 by Gardner Bender, Menomonee Falls , WI.
      2) Thumb-Tite Sealing Compound No. 4216-92 by Nu-Calgon, St. Louis, MO
4. Local Relay (RP) Panels For Chapel And Cultural Center Systems:
   a. 16-ga (1.59 mm) screw cover, painted sheet metal. Box with cover and knockouts, pre-
      wired terminal strips, relay, and transformer.
   b. Provide Labels with Distributor contact information on each panel.
   c. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
5. \text{CO}_2\ Return Air Sensor:
   a. Duct mount with display.
   b. Category Four Approved Product. See Section 01 6200 for definitions of Categories:
      1) Honeywell: C7232B1006.
6. Control for Electric Wall Heater:
   a. Electric Heater Control:
      1) Category Four Approved Product. See Section 01 6200 for definitions of Categories:
         b) Disconnect Heater Overload: FMS-TAX5, 2-Pole 1 HP starter switch.
7. Combination Equipment and Thermal Overload Switch Panel:
   a. CEO panel must be provided by approved panel builder. See Section 01 6200 for definitions
      of Categories:
E. Operation Sequences:
   1. Programmable controller shall control Unoccupied and Occupied status of fan system based on
      adjustable seven-day program. Fan shall run continuously in Occupied Mode and cycle in
      Unoccupied Mode.
   2. Adjustable heating and cooling set points shall control space temperature by activating either
      heating or cooling equipment. Programmable controller provides automatic change over between
      heating and cooling.
   3. Controller provides optional override by allowing timed override of program by pushing override
      on controller touch screen. This shall activate controller to Occupied Mode and system shall
      control to Occupied set point.
   4. Minimum outdoor ventilation air damper, spring return type, shall open in controller Occupied
      Mode and remain closed in Unoccupied Mode.
   5. Systems with CO\textsubscript{2} sensor to control minimum, spring return type, outdoor ventilation air damper:
      a. Damper shall open in controller Occupied Mode only when CO\textsubscript{2} sensor setpoint of 1200 ppm
         is reached. Damper shall close if CO\textsubscript{2} level drops below 1100 ppm.
      b. Damper shall remain closed in controller Unoccupied Mode.
   6. Systems with Ventilator:
      a. Systems with CO\textsubscript{2} sensor to control outdoor ventilation air damper, Ventilation fan in
         controller shall activate ONLY when TWO conditions are present:
         1) Controller is in Occupied Mode.
         2) CO\textsubscript{2} sensor setpoint of 1200 ppm is reached.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Acceptable Installers. See Section 01 4301:
   1. Approved HVAC Sub-Contractors shall be pre-approved and included in Construction Documents
      by Addendum.

3.2 INSTALLATION

A. Interface With Other Work:
   1. Calibrate room controllers as required during air test and balance. Insulate sensor J-box with
      fiberglass insulation; expandable/ foam insulation is NOT acceptable.
   2. Instruct air test and balance personnel in proper use and setting of control system components.
   3. Install low voltage electrical wiring in accordance with Division 26 of these Specifications.

B. Echelon Communication: Ebus
   1. Ebus cable needs to be installed at least 12 inches (300 mm) from lighting, motors, or low voltage
      switching cables

C. Zone Panel:
   1. Zone panel shall be mounted by mechanical equipment with associated LCBS module in close
      proximity but mounted 24 inches (610 mm) apart.
   2. Zone panel shall be mounted at eye level and accessible for visual inspection.
   3. Install discharge air sensor 6 feet (1.80 m) downstream from a/c coil.
   4. Install OA sensor in fresh air duct.
   5. TOD relay for fresh air damper which is not part of zone panel shall be mounted in close proximity
      to panel and clearly labeled such.
   6. Zone panel shall be programmed for appropriate amount of zones and control.
   7. Zone dampers shall use three (3) wires for LED damper display.
   8. Power for zone transformer shall come from mechanical equipment for service switch disconnect.
9. Zone and bypass dampers shall have actuation component positioned such as for visual damper position inspection.
10. Set minimum zone damper position to 30 percent or setting number 3.

D. Control for Electric Wall Heater.
1. Install according to local code the electric heater RIB with overload disconnect into electric heater unit.
2. Commission controller to be seen by gateway and webpage.

E. Safety Controls: Interlock duct smoke detectors to keep heating, cooling, and system fan from operating when detector is energized.

F. Mount damper actuators and actuator linkages external of airflow. Make certain dampers operate freely without binding or with actuator housing moving.

G. Paste copy of record control wiring diagram on back of relay panel door cover for each multiple furnace system.

3.3 FIELD QUALITY CONTROL

A. Field Tests:
1. Calibrate, adjust, and set controls for proper operation, operate systems, and be prepared to prove operation of any part of control system. This work is to be completed before pre-substantial completion inspection.
2. Test each individual heating, cooling, and damper control for proper operation using control system.

3.4 SYSTEM STARTUP

A. For systems with LCBS Controller.
1. Contractor is responsible for a fully functioning control system accessible via internet web browser. Contractor is responsible to coordinate Network start up with assistance from local IT technician. Local IT technician shall provide available ports on network switch for LCBS gateway.
2. Contractor is responsible configuring all controllers with proper zone names, zone scheduling, proper Church conference / holiday scheduling, all to be coordinated with local FM manager. Set proper clock setting including day/month/year.
3. Set Heating / Cooling to proper stages
4. Set heat cycle rates to 9 cph and cooling to 4 cph.
5. Set DO1 relay to “Occupancy”.
7. Set fan switch operation to “ON”.
8. Set minimum UnOcc start time for all days. No days shall be scheduled Unconfigured.
9. Set Occupied start times to match meeting start times; provided by local FM manager.
10. Place all zone over-ride durations to one (1) hour except for Bishop and Stake area which shall be set to two (2) hours.
11. Set Occupied default heating setpoints to 68 degrees, cooling setpoints to 74 degrees.
12. Set Unoccupied default heating setpoint to 60 degrees, cooling setpoints to 90 degrees.
13. Set each zone to applicable Holiday scheduling for General & Stake Conferences.

B. For systems with TrueZONE Zone Panel:
1. Contractor responsible for fully functioning zoning system connected to LCBS controller system.
2. Contractor responsible to configuring of zone panel.
3. Contractor responsible to coordinate Network start up with assistance from air balancer.
3.5 ADJUSTING

A. LCBS controller configuration settings; the following are configuration guidelines for consistent installations:

1. Temperature Units Fahrenheit/ Celsius
2. Equipment Type Conventional/heat pump.
   a. Stages of Heat 1,2
   b. Stages of Cool 1,2
   c. Fan operation in heat mode Enable Fan w/ Heat
3. Equipment Options
   a. Leave at Default
   b. Heating Cycles per Hour 6-9 cph
   c. Cooling Cycles per Hour 3-4 cph
4. Economizer / DLC
   a. Configure as required by control equipment.
5. Sensor Selection
   a. Set according to averaging sensors
   b. Set to multi sensor "Smart" when averaging.
   c. Set Occupancy Sensor to "Disable".
6. Terminal Assignment
   a. Set according to equipment
   b. Set Terminal DO1 to Occupancy to control fresh air damper based upon scheduled occupancy or over-ride.
7. Miscellaneous
   a. Leave at default
8. Sensor setting
   a. Leave at default
   b. Set as Required
9. Accessory Loops – Set as required
   a. Ventilation Fan
   b. Other
10. Configure Zone Name (display on Home Screen).
11. Set Password to ABCD.
12. Set Occupied Setpoint
13. Set Unoccupied Setpoint
14. Set Schedule
15. MENU/ Holiday-Event Scheduler / Custom Events/ Create new event.
   a. Eastern Time Zone:
      1) First Sunday in April: Occupied Chapel from 11:30 am – 6:00 pm / every year.
      2) First Sunday in April: Unoccupied all other zones for all day / every year.
      3) First Sunday in October: Occupied Chapel from 11:30 am – 6:00 pm / every year.
      4) First Sunday in October: Unoccupied all other zones for all day / every year.
   b. Central Time Zone:
      1) First Sunday in April: Occupied Chapel from 10:30 am – 5:00 pm / every year.
      2) First Sunday in April: Unoccupied all other zones for all day / every year.
      3) First Sunday in October: Occupied Chapel from 10:30 am – 5:00 pm / every year.
      4) First Sunday in October: Unoccupied all other zones for all day / every year.
   c. Mountain Time Zone:
      1) First Sunday in April: Unoccupied all zones for all day / every year.
      2) First Sunday in April: Unoccupied all other zones for all day / every year.
      3) First Sunday in October: Unoccupied all zones for all day / every year.
      4) First Sunday in October: Unoccupied all other zones for all day / every year.
   d. Pacific Time Zone
      1) First Sunday in April: Occupied Chapel from 8:30 am – 3:00 pm / every year.
      2) First Sunday in April: Unoccupied all other zones for all day / every year.
      3) First Sunday in October: Occupied Chapel from 8:30 am – 3:00 pm / every year.
      4) First Sunday in October: Unoccupied all other zones for all day / every year.
B. Zone Panel Configuration:
   1. Configuration:
      a. Conventional or Heatpump.
      b. Cooling stages: (match equipment).
      c. Heat stages: (match equipment).
      d. RF enabled: (NO).
      e. Zones Installed: (match number of zones).
      f. Heat Staging Control: (percent Zones).
   2. Advanced Configuration:
      a. Heat Fan Control (HVAC).
      b. Purge Time: (2 minutes).
      c. Fan in Purge (HVAC):
      d. Purge Dampers: (Unchanged).
      e. Changeover delay: (15 minutes).
      f. DA temperature Sensor: (Yes).
      g. DA temperature High Limit: (140 degree).
      h. DA Low Limit: (35 degree).
      i. DAT MSTG Inhibit: (Yes).
      j. MSTG OT Lockout: (No).
   3. Save Changes.

3.6 CLOSEOUT ACTIVITIES

A. Instruction Of Owner:
   1. Include as part of training required in Section 23 0501, following training:
      a. Training shall be by personnel of installing company and utilize operator's manuals and as-built documentation.
      b. Provide training in (2) two sessions including LCBS Connect sight & smart Apps for up to six (6) hours total:
         1) First session will occur between system completion and Substantial Completion.
         2) Second session will occur within forty-five (45) days of Substantial Completion when agreed upon by Owner.
      c. Training shall include sequence of operation review, selection of displays, modification of schedules and setpoints, troubleshooting of sensors, etc, as follows:
         1) Control System Overview:
            a) Show access to system through both individual controllers and Internet browser and how network works. Scheduling building at minimum for Stake and General Conference, special events.
         2) Controller Programming from Keypad: Instructions on developing setpoints and schedules and adjusting local zone temperatures.
         3) Web Internet training with local Facilities Manager during two (2) sessions.
            a) Review all features accessible from the 'Settings' tab including Alarm points, user access, scheduling and humidity setpoints (where applied).

END OF SECTION

ATTACHMENTS
CERTIFICATE OF SPONSORSHIP
Electric and Electronic Control System for HVAC Installer

<table>
<thead>
<tr>
<th>PROJECT INFORMATION (To be filled out by Installer - available from project specification):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Name:</td>
</tr>
<tr>
<td>Project Number:</td>
</tr>
<tr>
<td>Project Address:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INSTALLER INFORMATION (To be filled out by Installer):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installer Name:</td>
</tr>
<tr>
<td>Installer Firm:</td>
</tr>
<tr>
<td>Installer Address:</td>
</tr>
</tbody>
</table>

I acknowledge and confirm the above listed Installer has received training and exhibit LCBS Connect System skills and is qualified to install the automation control system as specified for Project identified above. Our company will stand behind the Installer meeting the legal specified performance requirements.

Sponsoring Approved Honeywell Distributor Name: ____________________________

Signature: ____________________________ Printed Signature: ____________________________

Date: ____________________________
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Perform excavation and backfill required for work of this Section.
   2. Furnish and install gas piping and fittings within building and from building to meter including connection to meter as described in Contract Documents.

B. Related Requirements:
   1. Sections Under 09 9000 Heading: 'Paints And Coatings' for painting of exterior piping.
   2. Section 23 0501: 'Common HVAC Requirements'.
   3. Section 23 0553: 'Identification for HVAC Piping and Equipment'.
   5. Section 31 2323: 'Fill' for procedure and quality of backfill and compaction.
   6. Section 33 5100: 'Natural-Gas Distribution' for gas line from meter to main.

1.2 REFERENCES

A. Reference Standards:
   1. American National Standards Institute / CSA Group:
part 2 - products

2.1 system

c. conbraco industries, inc, matthews, nc www.conbraco.com or conbraco / honeywell ltd, scarborough, on (416) 293-8111.
f. jomar international, madison heights, mi www.jomar.com.
g. california valves (formally koso) by pacific seismic products inc, lancaster, ca, distributed by strand earthquake consultants www.strandearthquake.net.
h. viega llc, broomfield, co www.viega.com.
The Church of Jesus Christ of Latter-day Saints  
Garden City Assembly Hall


B. Materials:
1. Above-Ground Pipe:
   a. Black carbon steel, butt welded, Schedule 40 pipe meeting requirements of A53/A53M.
2. Above-Ground Pipe Fittings:
   a. Welded forged steel fittings meeting requirements of ASTM A234/A234M.
   b. Standard weight malleable iron screwed.
3. Below-Ground Pipe And Fittings: Polyethylene pipe and fittings meeting requirements of ASTM D2513 with No. 14 coated copper trace wire.
4. Valves:
   a. 125 psi (862 kPa) bronze body ball valve, UL listed.
   b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) CIM 102.1 by Cimbrio Valve.
      2) Apollo Series 80-100 by ConBraCo.
      3) 'Red Cap' R602 by Jenkins NH Canada.
      4) Model T-204 by Jomar International.
      5) Model B-6000-UL by Watts Regulator.
5. Cocks:
6. Flexible Connector:
   a. Type 304 stainless steel corrugated tube coated for corrosion protection.
   b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) Dormont Supr-Safe.
      2) BrassCraft Procoat.
7. Seismic Valves:
   a. Natural gas seismic shut-off valves.
      1) Rate at maximum 20 psi (138 kPA) pressure with positive seating from minus 40 deg F to plus 150 deg F (minus 40 deg C to plus 66 deg C) for exterior mounting near gas meter.
      2) UL listed valve, factory set for IBC Seismic Design Category D.
      3) Size to be determined by total cu ft (0.028 cu m) per hour gas flow requirement of building and following conditions: 0.1 inch (2.54 mm) water column maximum allowable pressure-drop through valve with available pressure of 4 oz (113 grams).
      4) Category Four Approved Product. See Section 01 6200 for definitions of Categories:
         a) California Seismic Gas Shutoff Valve (formally KOSO):
            1) Horizontal installation: Model 314F or 315F.
            2) Vertical installation with bottom inlet: Model VB314F or VB315F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Steel pipe installed through air plenums, in walls:
   1. Pipes 2-1/2 inches (64 mm) and larger shall have welded fittings and joints.
   2. Other steel pipe may have screwed or welded fittings.
   3. Viega MegaPressG:
      a. Install MegaPressG fittings according to Manufacture's recommendations and with Manufacture's recommended tools.

B. Lay underground pipe in accordance with Manufacturer's recommendations and local gas utility company regulations and specifications.
   1. Provide 24 inch (610 mm) minimum steel pipe between vertical rise of riser and end of polyethylene line if anode-less riser is not used. Use plastic-to-steel transition or compression
fitting between end of polyethylene line and steel meter riser. Provide cathodic protection for steel riser or use anode-less riser.
2. Place tracer wire along side of polyethylene pipe from meter to point where pipe rises inside building.
3. Place 4 inches (100 mm) of sand around gas line buried underground.
4. Do not install gas piping under building floor slabs-on-grade.

C. After gas meter, valves, seismic valve and etc, gas piping should rise inside outside wall and not be visible to public.

D. On lines serving gas-fired equipment, install gas cocks adjacent to equipment outside of equipment cabinet and easily accessible.

E. Install 6 inch (150 mm) long minimum dirt leg, with pipe cap, on vertical gas drop serving each gas-fired equipment unit.

F. Use fittings for changes of direction in pipe and for branch runouts.

G. Visible gas piping inside building shall be painted yellow and labeled.

H. Install seismic valve in 24 inch (610 mm) long pipe section anchored to building wall at each end.

3.2 FIELD QUALITY CONTROL

A. Field tests:
   1. Subject all portions of gas piping system, in sections or in entirety, to air pressure of 75 psig (0.52 MPa) and prove airtight for four (4) hours.
   2. Disconnect equipment not suitable for 75 psig (0.52 MPa) pressure from piping system during test period.
SECTION 23 2300

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install piping and specialties for refrigeration systems as described in Contract Documents.

B. Related Requirements:
   1. Section 23 0501: 'Common HVAC Requirements'.
   2. Section 23 0719: 'Refrigerant Piping Insulation'.
   3. Section 23 6214: 'Compressor Units: Air Conditioning (5 Ton or less)'.
   4. Section 23 6216: 'Compressor Units: Heat Pumps (5 Ton or less)'.
   5. Section 23 8216.01: 'Air Coils: DX'.
   6. Section 23 8219: 'Fan Coil Units'.

218036 / Garden City Assembly Hall

23 2300 - 1

REFRIGERANT PIPING
1.2 REFERENCES

A. Association Publications:
   1. Federal Emergency Management Agency (FEMA) / Vibration Isolation and Seismic Control Manufacturers Association (VISCMA) / American Society of Civil Engineers (ASCE):
      a. FEMA 412, 'Installing Seismic Restraints For Mechanical Equipment' (December 2002).
   2. Vibration Isolation and Seismic Control Manufacturers Association (VISCMA):
      b. VISCMA 102-12, 'Vibration Isolation Specification Guidelines for Mechanical, Electrical, and Plumbing Systems'.

B. Definitions:
   1. Refrigerant:  Absorbs heat by a change of state (evaporation) from liquid to a gas, and releases heat by a change of state (condenses) from gas back to a liquid.
   2. Vibration Isolation:  Vibration reduction in which an isolation system is placed between the source of unwanted vibration and an item which needs to be shielded from the vibration.

C. Reference Standards:
   1. American National Standards Institute (ANSI) / American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
      a. ANSI/ASHRAE 5-2013 (packaged w/ 34-2013, 'Safety Standard and Designation and Classification of Refrigerants'.
   2. American National Standards Institute / American Welding Society:
      a. ANSI/AWS A5.8M/A5.8-2011, 'Specification for Filler Metals for Brazing and Braze Welding'.
   3. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
         1) Chapter 48, 'Noise and Vibration Control'.
   4. ASTM International:
      a. ASTM A36/A36M-14, 'Standard Specification for Carbon Structural Steel'.
      b. ASTM B280-13, 'Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service'.
   5. National Fire Protection Association / American National Standards Institute:
      a. NFPA 90A-2015, 'Installation of Air Conditioning and Ventilating Systems'.
   6. Underwriters Laboratories:
      a. UL 2182, 'Refrigerants' (April 2006).

1.3 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:  Show each individual equipment and piping support.

B. Informational Submittals:
   1. Qualification Statements:  Technician certificate for use of HFC and HCFC refrigerants.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Refrigerants:
      a. Underwriters Laboratories / Underwriters Laboratories of Canada:
         1) Comply with requirements of UL 2182.

B. Qualifications.  Section 01 4301 applies, but is not limited to the following:
   1. Installer:  Refrigerant piping shall be installed by refrigeration contractor licensed by State and by technicians certified in use of HFC and HCFC refrigerants.
PART 2 - PRODUCTS

2.1 COMPONENTS

A. Manufacturers:
   1. Manufacturer Contact List:
      e. Emerson Climate Technologies, St Louis, MO www.emersonflowcontrols.com.
      g. Harris Products Group, Cincinnati, OH www.harrisproductsgroup.com.
      o. Parker Corp, Cleveland, OH www.parker.com.
      v. Virginia KMP Corp, Dallas, TX www.virginiakmp.com.

B. Materials:
   1. Refrigerant Piping:
      b. Do not use pre-charged refrigerant lines.
   2. Refrigerant Fittings:
      a. Wrought copper with long radius elbows.
      b. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
         1) Mueller Streamline.
         2) Nibco Inc.
         3) Elkhart.
   3. Suction Line Traps:
      a. Manufactured standard one-piece traps.
      b. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
         1) Mueller Streamline.
         2) Nibco Inc.
         3) Elkhart.
   4. Tee Access:
      a. Brass:
         1) Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
            a) JB Industries: Part #A3 Series with Factory Cap and Valve Core.
      5. Connection Material:
         a. Brazing Rods in accordance with ANSI/AWS A5.8M/A5.8:
            1) Copper to Copper Connections:
               a) Classification BCuP-4 Copper Phosphorus (6 percent silver).
               b) Classification BCuP-5 Copper Phosphorus (15 percent silver).
2) Copper to Brass or Copper to Steel Connections: Classification BAg-5 Silver (45 percent silver).
3) Do not use rods containing Cadmium.

b. Flux:
   1) Type Two Acceptable Products:
      a) Stay-Silv White Brazing Flux by Harris Products Group.
      b) High quality silver solder flux by Handy & Harmon.
      c) Equal as approved by Architect before use. See Section 01 6200.

6. Valves:
   a. Manual Refrigerant Shut-Off Valves:
      1) Ball valves designed for refrigeration service and full line size.
      2) Valve shall have cap seals.
      3) Valves with hand wheels are not acceptable.
      4) Provide service valve on each liquid and suction line at compressor.
      5) If service valves come as integral part of condensing unit, additional service valves shall not be required.
   b. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
      a) Henry.
      b) Mueller.
      c) Sherwood.
      d) Virginia.

7. Filter-Drier:
   a. On lines 3/4 inch (19 mm) outside diameter and larger, filter-drier shall be replaceable core type with Schraeder type valve.
   b. On lines smaller than 3/4 inch (19 mm) outside diameter, filter-drier shall be sealed type with brazed end connections.
   c. Size shall be full line size.
   d. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
      1) Emerson Climate Technologies.
      2) Mueller.
      3) Parker.
      4) Sporlan.
      5) Virginia.

8. Sight Glass:
   a. Combination moisture and liquid indicator with protection cap.
   b. Sight glass shall be full line size.
   c. Sight glass connections and sight glass body shall be solid copper or brass, no copper-coated steel sight glasses allowed.
   d. Category Four Approved Product. See Section 01 6200 for definitions of Categories:
      1) HMI by Emerson Climate Technologies.

9. Flexible Connectors:
   a. Designed for refrigerant service with bronze seamless corrugated hose and bronze braiding.
   b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) Vibration Absorber Model VAF by Packless Industries.
      2) Vibration Absorbers by Virginia KMP Corp.
      3) Anaconda ‘Vibration Eliminators’ by Universal Metal Hose.
      4) Style ‘BF’ Spring-flex freon connectors by Vibration Mountings.

10. Refrigerant Piping Supports:
   a. Base, Angles, And Uprights: Steel meeting requirements of ASTM A36.
   b. Securing Channels:
      1) At Free-Standing Pipe Support:
         a) Class One Quality Standard: P-1000 channels by Unistrut.
         b) Acceptable Manufacturers: Hilti, Thomas & Betts.
         c) Equal as approved by Architect before installation. See Section 01 6200.
      2) At Wall Support:
         a) Class One Quality Standard: P-3300 channels by Unistrut.
         b) Acceptable Manufacturers: Hilti, Thomas & Betts.
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

c) Equal as approved by Architect before installation. See Section 01 6200.

3) At Suspended Support:
   a) Class One Quality Standard: P-1001 channels by Unistrut.
   b) Acceptable Manufacturers: Hilti, Thomas & Betts.
   c) Equal as approved by Architect before installation. See Section 01 6200.

4) Angle Fittings:
   a) Class One Quality Standard: P-2626 90 degree angle by Unistrut.
   b) Acceptable Manufacturers: Hilti, Thomas & Betts.
   c) Equal as approved by Architect before installation. See Section 01 6200.

   c. Pipe Clamps:
      1) Type Two Acceptable Manufacturers:
         a) Hydra-Zorb.
         b) ZSI Cush-A-Clamp.
         d) Equal as approved by Architect before installation. See Section 01 6200.

   d. Protective Cover: 18 ga (1.2 mm) steel, hot-dipped galvanized.

11. Locking Refrigerant Cap:
   a. Provide and install on charging valves:
      1) Class One Quality Standard: 'No Vent' locking refrigerant cap.
      2) Acceptable Manufacturers: Airtec.
      3) Equal as approved by Architect before installation. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refrigerant Lines:
   1. Install as high in upper mechanical areas as possible. Do not install underground or in tunnels.
   2. Slope suction lines down toward compressor one inch/10 feet (25 mm in 3 meters). Locate traps at vertical rises against flow in suction lines.

B. Connections:
   1. Refrigeration system connections shall be copper-to-copper, copper-to-brass, or copper-to-steel type properly cleaned and brazed with specified rods. Use flux only where necessary. No soft solder (tin, lead, antimony) connections will be allowed in system.
   2. Braze manual refrigerant shut-off valve, sight glass, and flexible connections.
   3. Circulate dry nitrogen through tubes being brazed to eliminate formation of copper oxide during brazing operation.

C. Specialties:
   1. Install valves and specialties in accessible locations. Install refrigeration distributors and suction outlet at same end of coil.
   2. Install thermostatic bulb as close to cooling coil as possible. Do not install on vertical lines.
   3. Install equalizing line in straight section of suction line, downstream of and reasonably close to thermostatic bulb. Do not install on vertical lines.
   4. Provide flexible connectors in each liquid line and suction line at both condensing unit and evaporator on systems larger than five tons. Anchor pipe near each flexible connector.

D. Refrigerant Supports:
   1. Support Spacing:
      a) Piping 1-1/4 inch (32 mm) And Larger: 8 feet (2.450 m) on center maximum.
      b) Piping 1-1/8 inch (28.5 mm) And Smaller: 6 feet (1.80 m) on center maximum.
      c) Support each elbow.
   2. Isolate pipe from supports and clamps with Hydrozorb or Cush-A-Clamp systems.
   3. Run protective cover continuous from condensing units to risers or penetrations at building wall.
3.2 FIELD QUALITY CONTROL

A. Field Tests:
   1. Make evacuation and leak tests in presence of Architect's Engineer after completing refrigeration piping systems. Positive pressure test will not suffice for procedure outlined below.
      a. Draw vacuum on each entire system with two stage vacuum pump. Draw vacuum to 300 microns using micron vacuum gauge capable of reading from atmosphere to 10 microns. Do not use cooling compressor to evacuate system nor operate it while system is under high vacuum.
      b. Break vacuum with nitrogen and re-establish vacuum test. Vacuum shall hold for 30 minutes at 300 microns without vacuum pump running.
      c. Conduct tests at 70 deg F (21 deg C) ambient temperature minimum.
      d. Do not run systems until above tests have been made and systems started up as specified. Inform Owner's Representative of status of systems at time of final inspection and schedule start-up and testing if prevented by outdoor conditions before this time.
      e. After testing, fully charge system with refrigerant and conduct test with Halide Leak Detector.
      f. Recover all refrigerant in accordance with applicable codes. Do not allow any refrigerant to escape to atmosphere.

B. Non-Conforming Work:
   1. If it is observed that refrigerant lines are being or have been brazed without proper circulation of nitrogen through lines, all refrigerant lines installed up to that point in time shall be removed and replaced at no additional cost to Owner.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Coordinate installation of condensate drain piping with Section 22 0501 as described in Contract Documents.

B. Related Requirements:
   1. Section 22 0501: ‘Common Plumbing Requirements’.
   2. Section 23 0501: ‘Common HVAC Requirements’.

1.2 REFERENCES

A. Reference Standards:
   1. ASTM International:
PART 2 - PRODUCTS

2.1 SYSTEMS

A. Materials:
   1. Condensate Drains:
      a. Schedule 40 PVC for condensate drains from furnace combustion chambers and furnace cooling coils.
   2. Solvent Cement and Adhesive Primer:
      a. Use PVC solvent cement that has a VOC content of 510 g/L or less if required by local AHJ if required.
      b. Use adhesive primer that has a VOC content of 550 g/L or less if required by local AHJ if required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Condensate Drains:
   1. Support piping and protect from damage.
   2. Do not combine PVC condensate drain piping from furnace combustion chamber with copper condensate drain piping from cooling coil.

END OF SECTION
SECTION 23 3001
COMMON DUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY
A. Includes But Not Limited To:
   1. General procedures and requirements for ductwork.
   2. Repair leaks in ductwork, as identified by duct testing, at no additional cost to Owner.
B. Related Requirements:
   1. Section 01 4546: ‘Duct Testing, Adjusting, and Balancing’ for ductwork.

1.2 REFERENCES
A. Reference Standards:
   1. Sheet Metal And Air Conditioning Contractors’ National Association / American National Standards Institute:

1.3 ADMINISTRATIVE REQUIREMENTS
A. Pre-Installation Conference: Schedule conference immediately before installation of ductwork.
1.4 SUBMITTALS

A. Action Submittals:
   1. Product Data: Specification data on sealer and gauze proposed for sealing ductwork.
   2. Samples: Sealer and gauze proposed for sealing ductwork.

B. Informational Submittals:
   1. Manufacturer Instructions:
      a. Installation manuals providing detailed instructions on assembly, joint sealing, and system pressure testing for leaks.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Performance:
   1. Design Criteria:

B. Materials:
   1. Duct Hangers:
      a. One inch (25 mm) by 18 ga (1.27 mm) galvanized steel straps or steel rods as shown on Drawings, and spaced not more than 96 inches (2,400 mm) apart. Do not use wire hangers.
      b. Attaching screws at trusses shall be 2 inch (50 mm) No. 10 round head wood screws. Nails not allowed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. During installation, protect open ends of ducts by covering with plastic sheet tied in place to prevent entrance of debris and dirt.

B. Make necessary allowances and provisions in installation of sheet metal ducts for structural conditions of building. Revisions in layout and configuration may be allowed, with prior written approval of Architect. Maintain required airflows in suggesting revisions.

C. Hangers And Supports:
   1. Install pair of hangers as required by spacing indicated in table on Drawings.
   2. Install upper ends of hanger securely to floor or roof construction above by method shown on Drawings.
   3. Attach strap hangers to ducts with cadmium-plated screws. Use of pop rivets or other means will not be accepted.
   4. Secure vertical ducts passing through floors by extending bracing angles to rest firmly on floors without loose blocking or shimming. Support vertical ducts, which do not pass through floors, by using bands bolted to walls, columns, etc. Size, spacing, and method of attachment to vertical ducts shall be same as specified for hanger bands on horizontal ducts.
3.2 CLEANING

A. Clean interior of duct systems before final completion.

END OF SECTION
### SECTION 23 3114

**LOW-PRESSURE METAL DUCTS**

**PART 1 - GENERAL**

#### 1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install above-grade low-pressure steel ducts and related items as described in Contract Documents.

B. Products Installed But Not Furnished Under This Section:
   1. Duct smoke detectors.
   2. Air Coils: 'Water'.
C. Related Requirements:
1. Section 01 4546: ‘Duct Testing, Adjusting, And Balancing’ for duct test, balance, and adjust air duct systems services provided by Owner.
2. Section 23 0713: ‘Duct Insulation’ for thermal Insulation for ducts, plenum chambers, and casings.
4. Section 23 0933: ‘Electric And Electronic Control System For HVAC’:
   a. Temperature control damper actuators and actuator linkages.
   b. Furnishing of duct smoke detectors.
5. Section 23 8216.02: ‘Air Coils: Water’.

1.2 REFERENCES

A. Association Publications:
1. Sheet Metal And Air Conditioning Contractors’ National Association / American National Standards Institute:

B. Reference Standards:
1. ASTM International:
   a. ASTM A653/A653M-13, ‘Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process’.
2. Underwriters Laboratories, Inc.:

1.3 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. Duct Sealer:
   a. Meet Class A flame spread rating in accordance with ASTM E84 or UL 723.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements:
1. Duct Sealer:
   a. Handle, store, and apply materials in compliance with applicable regulations and material safety data sheets (MSDS).
   b. Handle to prevent inclusion of foreign matter, damage by water, or breakage.
   c. Store in a cool dry location, but never under 35 deg F (1.7 deg C) or subjected to sustained temperatures exceeding 110 deg F (43 deg C) or as per Manufacturer's written recommendations.
   d. Do not use sealants that have exceeded shelf life of product.

1.5 FIELD CONDITIONS

A. Ambient Conditions:
1. Duct Sealer:
   a. Do not apply under 35 deg F (1.7 deg C) or subjected to sustained temperatures exceeding 110 deg F (43 deg C) or as per Manufacturer's written recommendations.
   b. Do not apply when rain or freezing temperatures will occur within seventy two (72) hours.
PART 2 - PRODUCTS

2.1 SYSTEM

A. Materials:
   1. Sheet Metal:
      a. Fabricate ducts, plenum chambers and casings of zinc-coated, lock-forming quality steel
         sheets meeting requirements A653/A653M, with G 60 coating.
   2. Duct Sealer For Interior Ducts:
      a. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         1) Duct Butter or ButterTak by Cain Manufacturing Co Inc, Pelham, AL
         2) DP 1010, DP 1030 or DP 1015 by Design Polymerics, Fountain Valley, CA
         3) PROseal, FIBERseal, EVERseal, or EZ-seal by Ductmate Industries, Inc., Charleroi, PA
         4) SAS by Duro Dyne, Bay Shore, NY or Duro Dyne Canada, Lachine, QB
         6) MTS100 or MTS 200 by Hercules Mighty Tough, Denver CO,
         9) Airseal Zero by Polymer Adhesive Sealant Systems Inc, Weatherford, TX
         10) Airseal #22 Water Base Duct Sealer by Polymer Adhesive Sealant Systems Inc, Weatherford, TX
   3. Duct Sealer For Exterior Ducts:
      a. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         1) Two Part II Sealing System including RTA-50 liquid adhesive and DT-5300 for 3 inch
            (76 mm) and DT 5400 for 4 inch (100 mm) tape by Hardcast Inc, Wylie, TX
   B. Fabrication:
      1. General:
         a. Straight and smooth on inside with joints neatly finished.
         b. Duct drops to diffusers shall be round, square, or rectangular to accommodate diffuser neck.
            Drops shall be same gauge as branch duct. Seal joints air tight.
      2. Standard Ducts:
         a. General:
            1) Ducts shall be large enough to accommodate inside acoustic duct liner. Dimensions
               shown on Drawings are net clear inside dimensions after duct liner has been installed.
         b. Rectangular Duct:
            1) Duct with height or width over 36 inches (900 mm) shall be fabricated using SMACNA
               T-24 flange joints or of pre-fabricated systems as follows:
               a) Ducts with sides over 36 inches (900 mm) up to 48 inches (1 200 mm):
                  Transverse duct joint system by Ductmate / 25, Elgen, Ward, or WDCI (SMACNA
                  Class 'F' joint).
               b) Ducts 48 inch (1 200 mm) And Larger: Ductmate / 35, Elgen, or WDCI (SMACNA
                  Class 'J' transverse joint).
               c) Category Four Approved Products. See Section 01 6200 for definitions of
                  Categories:
                  (1) Ductmate Industries Inc, Charleroi, PA  www.ductmate.com or Ductmate
                      Canada Ltd, Burlington, ON (905) 332-7678.
         c. Round Duct:
1) Spiral Seam:
   a) 28 ga (0.38 mm) minimum for ducts up to and including 14 inches (355 mm) in diameter.
   b) 26 ga (0.46 mm) minimum for ducts over 14 inches (355 mm) and up to and including 26 inches (660 mm) in diameter.

2) Longitudinal Seam:
   a) 28 ga (0.38 mm) minimum for ducts up to and including 8 inches (200 mm) in diameter.
   b) 26 ga (0.46 mm) minimum for ducts over 8 inches (200 mm) and up to 14 inches (355 mm) in diameter.
   c) 24 ga (0.61 mm) minimum for ducts over 14 inches (355 mm) up to and including 26 inches (660 mm) in diameter.

PART 3 - EXECUTION

3.1 PREPARATION

A. Metal duct surface must be clean and free of moisture, contamination and foreign matter before applying duct sealer for interior and exterior ducts.

3.2 INSTALLATION

A. Install internal ends of slip joints in direction of flow. Seal transverse and longitudinal joints air tight using specified duct sealer as per Manufacturer’s written instructions. Cover horizontal and longitudinal joints on exterior ducts with two layers of specified tape installed with specified adhesive.

B. Securely anchor ducts and plenums to building structure with specified duct hangers attached with screws. Do not hang more than one duct from a duct hanger. Brace and install ducts so they shall be free of vibration under all conditions of operation.

C. Ducts shall not bear on top of structural members.

D. Paint ductwork visible through registers, grilles, and diffusers flat black.

E. Properly flash where ducts protrude above roof.

F. Under no conditions will pipes, rods, or wires be allowed to penetrate ducts.

3.3 FIELD QUALITY CONTROL

A. Field Tests:
   1. Air Test and Balance Testing as specified in Section 01 4546: ‘Duct Testing, Adjusting, and Balancing’.

B. Non-Conforming Work:
   1. Reseal transverse joint duct leaks and seal longitudinal duct joint leaks discovered during air test and balance procedures at no additional cost to Owner.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install duct accessories in specified ductwork as described in Contract Documents.

B. Related Requirements:
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

1. Section 23 0933: 'Electric And Electronic Control System For HVAC' for temperature control damper actuators and actuator linkages.
2. Section 23 3001: 'Common Duct Requirements'.

1.2 REFERENCES

A. Reference Standards:
   1. ASTM International:
      a. ASTM A653/A653M-15, 'Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process'.
      b. ASTM C1071-12, 'Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)'.

PART 2 - PRODUCTS

2.1 ACCESSORIES

A. Manufacturers:
   1. Manufacturer Contact List:
      d. Air-Rite Manufacturing, Bountiful, UT (801) 295-2529.
      k. Daniel Manufacturing, Ogden, UT (801) 622-5924.
      q. Flexmaster USA Inc, Houston, TX www.flexmasterusa.com.
B. Materials:

1. Acoustical Liner System:
   a. Duct Liner:
      1) One inch (25 mm) thick, 1-1/2 lb (0.68 kg) density fiberglass conforming to requirements of ASTM C1071. Liner will not support microbial growth when tested in accordance with ASTM C1338.
      2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) ToughGard by CertainTeed.
         b) Duct Liner E-M by Knauf Fiber Glass.
         c) Akousti-Liner by Manson Insulation.
         d) Quiet R by Owens Corning.
         e) Linacoustic RC by Johns-Manville.
   b. Adhesive:
      1) Category Four Approved Water-Based Products. See Section 01 6200 for definitions of Categories:
         a) Cain: Hydrotak.
         b) Design Polymerics: DP2501 or DP2502 (CMCL-2501).
         c) Duro Dyne: WSA.
         d) Elgen: A-410-WB.
         e) Hardcast: Coil-Tack.
         f) Hercules: Mighty Tough Adhesives MTA500 or MTA600.
         g) Miracle / Kingco: PF-101.
         h) Mon-Eco: 22-67 or 22-76.
         i) Polymer Adhesive: Glasstack #35.
         j) Techno Adhesive: 133.
      2) Category Four Approved Solvent-Based (non-flammable) Products. See Section 01 6200 for definitions of Categories:
         a) Cain: Safetak.
         b) Duro Dyne: FPG.
         c) Hardcast: Glas-Grip 648-NFSE.
         d) Miracle / Kingco: PF-91.
         f) Polymer Adhesive: Q-Tack.
         g) Techno Adhesive: 'Non-Flam' 106.
      3) Category Four Approved Solvent-Based (flammable) Products. See Section 01 6200 for definitions of Categories:
         a) Cain: HV200.
         b) Duro Dyne: MPG.
         c) Hardcast: Glas-Grip 636-SE.
         d) Miracle / Kingco: PF-96.
         e) Mon-Eco: 22-22.
         f) Polymer Adhesive: R-Tack.
         g) Techno Adhesive: 'Flammable' 106.
   c. Fasteners:
      1) Adhesively secured fasteners not allowed.
2) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
   a) AGM Industries: 'DynaPoint' Series RP-9 pin.
   b) Cain.
   c) Duro Dyne.
   d) Gripnail: May be used if each nail is installed by 'Grip Nail Air Hammer' or by
      'Automatic Fastener Equipment' in accordance with Manufacturer's
      recommendations.

2. Flexible Equipment Connections:
   a. 30 oz closely woven UL approved glass fabric, double coated with neoprene.
   b. Fire retardant, waterproof, air-tight, resistant to acids and grease, and withstand constant
      temperatures of 200 deg F (93 deg C).
   c. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) Cain: N-100.
      2) Duro Dyne: MFN.
      4) Elgen: ZLN / SDN.
      5) Ventfabrics: Ventglas.
      6) Ductmate: ProFlex.

3. Duct Access Doors:
   a. General:
      1) Factory built insulated access door with hinges and sash locks, as necessary.
         Construction shall be galvanized sheet metal, 24 ga (0.635 mm) minimum.
      2) Fire and smoke damper access doors shall have minimum clear opening of 12 inches
         (300 mm) square or larger as shown on Drawings.
   b. Rectangular Ducts:
      1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) Air Balance: Fire/Seal FSA 100.
         b) Air-Rite: Model HAD-2.
         c) Cesco: HDD.
         d) Elgen: TAB Type / Hinge and Cam.
         e) Flexmaster: Spin Door.
         f) Kees: ADH-D.
         g) Nailor: 08SH.
         h) Pottorff: 60-HAD.
         j) United Enertech: L-95.
   c. Round Ducts:
      1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) Ductmate: 'Sandwich' Access Door.
         b) Elgen: Sandwich Access Door.
         c) Kees: ADL-R.
         d) Nailor: 0809.
         e) Pottorff: RAD.
         f) Ruskin: ADR.
         g) Ward: DSA.

4. Dampers And Damper Accessories:
   a. Locking Quadrant Damper Regulators:
      1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         c) Elgen: EQR-4.
         d) Ventfabrics: Ventline 555.
         e) Young: No. 1.
   b. Concealed Ceiling Damper Regulators:
      1) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         a) Cain.
         b) Duro Dyne.
         c) Elgen.
c. Volume Dampers:

1) Rectangular Duct:
   a) Factory-manufactured 16 ga (1.6 mm) galvanized steel, single blade and opposed blade type with 3/8 inch (9.5 mm) axles and end bearings. Blade width 8 inches (200 mm) maximum. Blades shall have 1/8 inch (3 mm) clearance all around.
   b) Damper shall operate within acoustical duct liner.
   c) Provide channel spacer equal to thickness of duct liner.
   d) Dampers above removable ceiling and in Mechanical Rooms shall have locking quadrant on bottom or side of duct. Otherwise, furnish with concealed ceiling damper regulator and cover plate.
   e) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      (1) Air-Rite: Model CD-2.
      (2) American Warming: VC-2-AA.
      (3) Arrow: OBDAF-207.
      (4) C & S: AC40.
      (5) Cesco: AGO.
      (6) Daniel: CD-OB.
      (8) Nailor: 1810 or 1820.
      (9) Pottorff: CD-42.
      (10) Ruskin: MD-35.
      (12) Utemp: CD-OB.

2) Round Duct:
   a) Factory-manufactured 20 ga (1.0 mm) galvanized steel, single blade with 3/8 inch (9.5 mm) axles and end bearings.
   b) For use in outside air ducts.
   c) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      (1) Air Balance: Model AC-22.
      (2) Air-Rite: Model CD-8.
      (3) American Warming: V-22.
      (4) Arrow: Type-70.
      (5) C & S: AC21R.
      (6) Cesco: MGG.
      (7) Nailor: 1890.
      (8) Pottorff: CD-21R.
      (9) Ruskin: MDRS-25.
      (10) United Enertech: RD.

2. Motorized Outside Air Dampers:

1) General:
   a) Low leakage type. AMCA certified.
   b) Make provision for damper actuators and actuator linkages to be mounted external of air flow.

2) Rectangular Ducts:
   a) Damper Blades:
      (1) Steel or aluminum airfoil type with mechanically locked blade seals, 8 inch (200 mm) blade width maximum measured perpendicular to axis of damper.
      (2) Jamb seals shall be flexible metal compression type.
      (3) Opposed or single blade type.
   b) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      (1) Air Balance: AC 526.
      (2) American Warming: AC526.
AIR DUCT ACCESSORIES

3) Round Ducts:
   a) Damper Blades:
      1) Steel with mechanically locked blade seals.
      2) Blade seals shall be neoprene or polyethylene.
      3) Single blade type.
   b) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      2) American Warming: VC25.
      3) Arrow: Type 70 or 75.
      4) C & S: AC25R.
      5) Cesco: AGG.
      6) Nailor: 1090.
      7) Pottorff: CD-25R.
      8) Ruskin: CD25.
      9) Tamco: Square-to-Round Series 1000.
     10) United Enertech: RI.

   e. Backdraft Dampers:
      1) Backdraft blades shall be nonmetallic neoprene coated fiberglass type.
      2) Stop shall be galvanized steel screen or expanded metal, 1/2 inch (13 mm) mesh.
      3) Frame shall be galvanized steel or extruded aluminum alloy.
   4) Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      a) Air-Rite: Model BDD-3.
      c) C & S: BD30.
      d) Pottorff: BD-51.
      e) Ruskin: NMS2.
      f) Utemp: BFEA.

5. Air Turns:
   b. 4-1/2 inch (115 mm) wide vane rail. Junior vane rail not acceptable.

6. Branch Tap for Flexible Ductwork:
   a. Factory-manufactured rectangular-to-round 45 degree leading tap fabricated of 24 ga (0.635 mm) zinc-coated lock-forming quality steel sheets meeting requirements of ASTM A653, with G-90 coating.
   b. One inch wide mounting flange with die formed corner clips, pre-punched mounting holes, and adhesive coated gasket.
   c. Manual Volume Damper:
      1) Single blade, 22 ga (0.79 mm) minimum
      2) 3/8 inch (9.5 mm) minimum square rod with brass damper bearings at each end.
      3) Heavy-duty locking quadrant on 1-1/2 inch (38 mm) high stand-off mounting bracket attached to side of round duct.
   d. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) ST-1HD by Air-Rite:
         a) Nylon damper bearings approved for Air-Rite.
      2) STO by Flexmaster.
      3) HET by Sheet Metal Connectors.

C. Fabrication:
1. Duct Liner:
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

a. Install mat finish surface on airstream side. Secure insulation to cleaned sheet metal duct with continuous 100 percent coat of adhesive and with 3/4 inch (19 mm) long mechanical fasteners 12 inches (300 mm) on center maximum unless detailed otherwise on Drawings. Pin all duct liner.
b. Accurately cut liner and thoroughly coat ends with adhesive. Butt joints tightly. Top and bottom sections of insulation shall overlap sides. If liner is all one piece, folded corners shall be tight against metal. Ends shall butt tightly together.
c. Coat longitudinal and transverse edges of liner with adhesive.

2. Air Turns:
a. Permanently install vanes arranged to permit air to make abrupt turn without appreciable turbulence, in 90 degree elbows of above ground supply and return ductwork.
b. Quiet and free from vibration when system is in operation.

PART 3 - EXECUTION

3. INSTALLATION

A. Duct Liner:
1. Furnish and install acoustic lining in following types of rectangular ducts unless noted otherwise on Contract Documents:
   a. Supply air.
   b. Return air.
   c. Mixed air.
   d. Transfer air.
   e. Elbows, fittings, and diffuser drops greater than 12 inches (300 mm) in length.
2. Do not install acoustic lining in round ducts.

B. Flexible Connections: Install flexible inlet and outlet duct connections to each furnace.

C. Access Doors In Ducts:
1. Install at each manual outside air damper and at each motorized damper. Locate doors within 6 inches (150 mm) of installed dampers.
2. Install within 6 inches (150 mm) of fire dampers and in Mechanical Room if possible. Install on side of duct that allows easiest access to damper.

D. Dampers And Damper Accessories:
1. Install concealed ceiling damper regulators.
   a. Paint cover plates to match ceiling tile.
   b. Do not install damper regulators for dampers located directly above removable ceilings or in Mechanical Rooms.
2. Provide each take-off with an adjustable volume damper to balance that branch.
   a. Anchor dampers securely to duct.
   b. Install dampers in main ducts within insulation.
   c. Dampers in branch ducts shall fit against sheet metal walls, bottom and top of duct, and be securely fastened. Cut duct liner to allow damper to fit against sheet metal.
   d. Where concealed ceiling damper regulators are installed, provide cover plate.
3. Install motorized dampers.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install supply air branch duct runouts to diffusers as described in Contract Documents.

B. Related Requirements:
   1. Section 23 3001: Common Duct Requirements.

1.2 REFERENCES

A. Reference Standards:
   1. National Fire Protection Association / American National Standards Institute:
   2. Underwriters Laboratories:
PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
   1. Manufacturer Contact List:
      b. Flexmaster USA Inc, Houston, TX  www.flexmasterusa.com or Flexmaster Canada Ltd, Richmond Hill, ON  (905) 731-9411.
      c. Thermaflex by Flexible Technologies, Abbeville, SC or Mississauga, ON  www.thermaflex.net.

B. Materials:
   1. Ducts:
      a. Formable, flexible, circular duct which shall retain its cross-section, shape, rigidity, and shall not restrict airflow after bending.
      b. Insulation:
         1) Nominal 1-1/2 inches (38 mm), 3/4 lb per cu ft (12 kg per cu m) density fiberglass insulation with air-tight, polyethylene or polyester core, sheathed in seamless vapor barrier jacket factory installed over flexible assembly.
         c. Assembly, including insulation and vapor barrier, shall meet Class I requirement of NFPA 90A and be UL 181 rated, with flame spread of 25 or less and smoke developed rating of 50 or under.
         d. Category Four Approved Products.  See Section 01 6200 for definitions of Categories:
            1) PR-25 by JP Lambornes.
            2) Flex-Vent KP by Thermaflex by Flexible Technologies.
            3) Type 1B Insulated by Flexmaster.
   2. Cinch Bands:  Nylon, 3/8 inch (9.5 mm) removable and reusable type.
      a. Listed and labeled in accordance with Standard UL 181B and labeled ‘UL 181 B-C’.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct in fully extended condition free of sags and kinks, using 72 inch (1 800 mm) maximum lengths.

B. Make duct connections by coating exterior of duct collar for 3 inches (75 mm) with duct sealer and securing duct in place over sheet metal collar with specified cinch bands.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install exhaust fans as described in Contract Documents.

B. Related Requirements:
   1. Section 23 3001: ‘Common Duct Requirements’.
   2. Division 26: Control device and electrical connection.

1.2 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Bear AMCA seal and UL label.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer Contact List:

2.2 MANUFACTURED UNITS

A. Ceiling Mounted Exhaust Fans:
   1. Acoustically insulated housings. Sound level rating of 5.0 sones maximum for CFM and static pressure listed on Contract Drawings.
   2. Include chatterproof integral back-draft damper with no metal-to-metal contact.
   3. True centrifugal wheels.
   4. Entire fan, motor, and wheel assembly shall be easily removable without disturbing housing.
   5. Suitably ground motors and mount on rubber-in shear vibration isolators.
   6. Provide wall or roof cap, as required.
   7. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      a. Acme: VQ.
      b. Broan: LoSone.
      c. Carnes: VCD.
      d. Cook: Gemini.
      e. Soler & Palau: FF.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Anchor fan units securely to structure or to curb.

END OF SECTION
SECTION 23 3713
DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install diffusers, registers, and grilles connected to ductwork as described in Contract Documents.

B. Related Requirements:
   1. Section 23 3001: ‘General Duct Requirements’.

1.2 SUBMITTALS

A. Maintenance Material Submittals:
   1. Tools: Leave tool for removing core of each different type of grille for building custodian.
2.1 MANUFACTURERS

A. Manufacturer Contact List:

2.2 MANUFACTURED UNITS

A. Ceiling Return And Transfer Grilles:
1. Finish: Off-white baked enamel.
2. 1/2 inch (12.7 mm) spacing.
4. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
   a. Carnes: RSLA.
   b. J & J: S90H.
   c. Krueger: S85H.
   d. Metal*Aire: SRH.
   e. Nailor: 6155H.
   g. Titus: 355RL or 355 RS.
   h. Tuttle & Bailey: T75D.

B. High Side Wall Return Grilles:
1. Finish: Off-white baked enamel.
2. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
   a. Metal*Aire: 41C.
   b. Krueger: 5810.
   c. Nailor: 51RC.
   d. Price: RCG.
   e. Titus: 1700.
   f. Tuttle & Bailey: AVF.

C. Side Wall Supply Grilles And Registers:
1. Finish: Off-white baked enamel.
2. Removable core.
3. Double deflection.
4. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
   b. Metal*Aire: 42C.
   c. Nailor: 51RCD.
   d. Price: RCG-DVS.
   e. Titus: 1707.
   f. Tuttle & Bailey: AVF.

D. Low Sidewall Return Grilles:
1. Finish: Off-white baked enamel.
2. 38 or 45 degree deflection.
3. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
   a. Carnes: RSHA.
   c. Krueger: S480H.
   d. Metal*Aire: HD-RH.
   e. Nailor: 6145H-HD.
   g. Titus: 33RL or 33RS.
   h. Tuttle & Bailey: T115D.

E. Ceiling Diffusers:
   1. Finish: Off-white baked enamel.
   2. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      a. Carnes: SKSA.
      c. Krueger: SH.
      d. Metal*Aire: 5500S.
      e. Nailor: 650OB.
      g. Titus: TDC-6.
      h. Tuttle & Bailey: M.

F. Soffit Grilles:
   2. Aluminum with aluminum mesh insect screen.
   3. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      a. Carnes: RAAA.
      b. J & J: ALS95H.
      c. Krueger: S585H.
      d. Metal*Aire: RHE.
      e. Nailor: 5155-IS.
      f. Price: 635.
      g. Titus: 355FL.
      h. Tuttle & Bailey: A75D.

G. Floor / Toe Space Return Grilles:
   1. Finish: Clear anodized.
   2. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      a. Carnes: CCJB (with mitered corners welded on face and sanded).
      c. Krueger: 1500F.
      d. Metal*Aire: 2000F.
      e. Nailor: 49-240-FN-MM.
      f. Price: LBPH-25B.
      g. Titus: CT-540.
      h. Tuttle & Bailey: 4000 CO.

PART 3 - EXECUTION

3.1 INSTALLATION

   A. Anchor securely into openings. Secure frames to ductwork by using four sheet metal screws, one per side. Level floor registers and anchor securely into floor.
3.2 ADJUSTING

A. Set sidewall supply register blades at 15 degrees upward deflection.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install louvers connected to ductwork as described in Contract Documents.

B. Related Requirements:

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer Contact List:
   5. Carnes Co, Verona, WI  www.carnes.com or Energy Technology Products LTD, Edmonton, AB (780) 468-1110.

2.2 MANUFACTURED UNITS

A. Louvers:
   1. General:
      a. Extruded aluminum, with blades welded or screwed into frames.
      b. Frames shall have mitered corners.
      c. Louvers shall be recessed, flanged, stationary, or removable as noted on Contract Documents.
      d. Finish:
         1) Polyvinylidene Fluoride (PVF$_2$) Resin-base finish (Kynar 500 or Hylar 5000) containing 70 percent minimum PVF$_2$ in resin portion of formula. Thermo-cured two coat system consisting of corrosion inhibiting epoxy primer and top coat factory applied over properly pre-treated metal.
         2) Color as selected by Architect from Manufacturer's standard colors.

   2. Louvers Connected To Ductwork:
      a. 1/2 inch (13 mm) mesh 16 ga (1.59 mm) aluminum bird screen.
      b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         1) K638 by Airolite.
         2) LE-1 by Air-Rite Manufacturing.
         3) LE48 by American Warming & Ventilating.
         4) EA-405 by Arrow United Industries.
         5) FKDA by Carnes.
         6) 455-XP by Industrial Louvers.
         7) EFK-445 by Pottorff.
         8) ELF81S30 by Ruskin.
         9) EL-4 by United Enertech.
        10) 2740-31 by Vent Products.
        11) EX by Wonder Metals.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Anchor securely into openings.

B. Where louvers touch masonry or dissimilar metals, protect with heavy coat of asphaltum paint.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install filters used in mechanical equipment.

B. Related Requirements:
   1. Section 23 3001: ‘Common Duct Requirements’.
   3. Section 23 8219: ‘Fan Coil Units’.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Furnace Filters: One inch (25 mm) thick throw-away type as recommended by Furnace Manufacturer.

B. Ventilation Units:
   1. Two inch (50 mm) thick pleated throw-away type as recommended by Ventilation Unit Manufacturer with ANSI/ASHRAE 52.2 MERV rating of 6 or higher.
3.1 INSTALLATION

A. Provide ample access for filter removal.

3.2 FIELD QUALITY CONTROL

A. Inspection: At date of Substantial Completion, air filters shall be new, clean, and approved by Owner's representative.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install flues as described in Contract Documents.

B. Related Requirements:
   1. Sections Under 09 9000 Heading: Painting.
   2. Section 23 0501: ‘Common HVAC Requirements’.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
   1. Manufacturer Contact List:
B. Materials:
   1. Flues:
      a. Double wall, factory-fabricated sectional type 'B', of aluminum construction designed to
         handle combustion products of fuel being used. Provide with inspection cap as required by
         local code, roof flashing, and clean-out.
      b. Size flues according to local codes except:
         1) No vertical flue shall have an area of less than 12-1/2 sq inches (80.65 sq cm), 4 inches
            (100 mm) in diameter.
         2) In no case shall vent connector be smaller than outlet collar provided by Manufacturer.
      c. Horizontal flue connectors shall be double wall.
      d. Fittings shall be pre-fabricated double wall.
      e. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         1) Ameri-Vent by AMPCO.
         2) Metal-Fab Inc.
         3) Metlvent by Hart & Cooley.
         4) Selkirk Metalbestos.
         5) Simpson Dura-Vent.
   2. Vent Caps:
      a. Non-backdraft type for installation on top of flue, aluminum construction.
      b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
         1) Mastervent Type MVR by Acme Engineering & Manufacturing.
         2) Ameri-cap by AMPCO.
         3) Type L by Breidert Air Products.

PART 3 - EXECUTION

3.1 INSTALLATION

   A. Height of flue above roof shall be as shown on Drawings unless local code requires it be higher.

   B. Every portion of flue connector shall have rise of one inch (25 mm) per 1 foot (300 mm) minimum from
      appliance to vertical flue.

   C. Length of horizontal flues or flue connectors shall not be longer than 75 percent of height of vertical
      flue between point at which horizontal flue enters vertical flue to top of vertical flue. In no case shall
      horizontal run exceed 15 feet (4.57 m).

   D. When two or more flue connections enter common vertical flue, smaller flue connector shall enter at
      higher level. Do not enter flue connectors in same horizontal plane.

   E. Every gas appliance flue shall have a 'backdraft preventer' installed at top of flue.

   END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install up-flow gas fired induced-draft type furnaces as described in Contract Documents.

B. Related Sections:
   1. Section 23 0501: ‘Common HVAC Requirements’.
   2. Section 23 1123: ‘Facility Natural Gas Piping’.
   4. Section 23 6214: ‘Compressor Units: Air Conditioning (5 Ton or less)’ for DX Cooling.

1.2 SUBMITTALS

A. Informational Submittals:
   1. Manufacturer Reports: Equipment check-out sheets.

B. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Warranty Documentation:
         1) Final, executed copy of Warranty.
      b. Record Documentation:
         1) Manufacturers Documentation:
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

a) Equipment checkout sheet: Complete and sign all items for each unit.

1.3 WARRANTY

A. Manufacturer’s Warranty:
   1. Provide Manufacturer’s Special LDS Warranty for the following:
      a. Provide fifteen (15) year minimum limited warranty of heat exchanger and five (5) year limited warranty on parts.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
   1. Manufacturer Contact List:
      a. Carrier Corporation:
         2) Carrier Utah: Bret Adams (Contractors HVAC Supply) (801) 224-1020 ext. 2527 bret.adams@chcsut.com.
      b. Lennox Industries:
         1) For pricing and information contact: Lennox National Account @ 1-800-367-6285.
         2) Lennox National Contact: Cody Jackson (801) 736-8904 Cody.Jackson@LennoxInd.com.
      c. Trane Company:
      d. York International:
         1) Brian Michael (405) 419-6230 brian.k.michael@jci.com.

B. Design Criteria:
   1. Rated at 80 percent minimum AFUE (Annual Fuel Utilization Efficiency) calculated in accordance with DOE test procedures:

C. Manufactured Units:
   1. Furnaces:
      a. Factory assembled units certified by AGA complete with blower section, vertical flow furnace section, steel casing, piped, and wired.
      b. Blower section shall consist of cabinet, blower, and motor:
         1) Cabinet shall be of 22 ga (0.8 mm) minimum cold rolled steel and have finish coat of baked-on enamel.
         2) Blower shall be Class 1, full DIDW, statically and dynamically balanced.
      c. Automatic controls shall consist of:
         1) 100 percent cut-off safety pilot.
         3) Operating automatic gas valve.
         4) Solid-state type fan and thermal limit controls.
         5) 24-volt transformer.
         6) Electronic ignition system.
         7) Pressure switch safety for induced draft fan, if required.
      d. Up-Flow Units:
         1) Blower shall be driven by motor with adjustable pitch V-belt drive or by multi-speed direct driven motor.
         2) Vertical up-flow furnace section shall be enclosed in 22 ga (0.8 mm) minimum enameled steel casing lined with foil covered insulation.
         3) Heat Exchanger:
            a) Aluminized steel.
b) 15-year minimum limited warranty.
4) Gas burners shall be aluminized steel. Orifice size shall be for 6,000 FT elevation.
5) Furnish and install twinning kit for dual furnace operation where required.

e. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
   1) Horizontal:
      a) Carrier: 58DLA.
      b) Lennox: ML180.
      c) York: TG8S.

2. Cooling Coil:
   a. Cooling coil shall consist of heavy gauge steel cabinet with baked-on enamel finish to match furnace:
      1) Coil shall have aluminum fins bonded to seamless copper or aluminum tubing.
      2) Coil shall be ARI rated. Provide drain pans with connections at one end.
      3) Use thermal expansion valve in place of capillary tube metering device.
      4) Do not include cooling coil and coil cabinet on furnaces serving zones where cooling is not required.
   b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) Horizontal:
         a) Carrier: CNPHP.
         b) Lennox: CH33.
         c) Trane: 4TXC.
         d) York: MC.
      2) Vertical:
         a) Carrier: CNPVP.
         b) Lennox: CX34.
         c) Trane: 4TXC.
         d) York: FC.

2.2 ACCESSORIES

A. Filter Frame:
   1. Build filter frame external to furnace as detailed on Contract Drawings. Do not use furnace Manufacturer’s filter kit.

B. Vibration Isolators:
   1. 4 inches (100 mm) square by 1/2 inch (12.7 mm) thick minimum neoprene type vibration isolation pads.

PART 3 - EXECUTION

3.1 INSTALLATION

1. Cooling Coil:
   a. Mount coils for tandem furnaces one of two following ways:
      1) Use separate coil for each furnace with both coils served by single condensing unit.
      2) Use single coil over both furnaces served by single condensing unit.

3.2 FIELD QUALITY CONTROL

A. Manufacturer Services:
   1. Furnace installer shall:
      a. Verify proper gas orifice size.
      b. Clock gas meter for rated input.
      c. Verify and set gas pressure at furnace.
      d. Check and measure temperature rise.
e. Check safety controls for proper operation.
f. Check combustion vent sizes and combustion air sizes.

2. In addition, furnace installer shall start up, check out, and adjust furnaces using equipment check-out sheet provided by Manufacturer. Complete and sign all items on sheet.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install compressor units as described in contract documents.

B. Related Sections:
1. Section 23 0501: 'Common HVAC Requirements'.
2. Section 23 2300: 'Refrigerant Piping'.
3. Section 23 5417: 'Gas-Fired Furnaces'.
2. Compressor Unit: Outside section of an air conditioning system which pumps vaporized refrigerant from the evaporator, compresses it, liquefies it in the condenser and returns it to the evaporator coil. The outdoor portion of a split system air conditioner contains the compressor and outdoor coil.

3. Condenser: Device used to condense refrigerant in a cooling system.

4. Condenser Coils: In a compressor unit, the coil dissipates heat from the refrigerant, changing the refrigerant from vapor to liquid.

5. Refrigerant: Absorbs heat by a change of state (evaporation) from liquid to a gas, and releases heat by a change of state (condenses) from gas back to a liquid.

6. SEER (Seasonal Energy Efficiency Ratio): Measure of cooling efficiency for air conditioners and heat pumps. A ratio of total cooling in comparison to electrical energy input in watts per hour. Higher the seer, the more energy efficient the unit. Since 2006, the minimum SEER required by the Department of Energy is 13.00 and 15.00+ SEER is considered high efficiency.

7. Split System: Combination of an outdoor unit (air conditioner or heat pump) with an indoor unit (furnace or air handler). Split systems must be matched for optimum efficiency.

B. Reference Standards:
1. American National Standards Institute / Air-Conditioning, Heating, and Refrigeration Institute:

2. American National Standards Institute / American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1.3 SUBMITTALS

A. Action Submittals:

B. Informational Submittals:
1. Tests and Evaluation Reports:

C. Special Procedure Submittals:
1. Installer must register with Manufacturer before submitting Manufacturer Warranty:
   a. Installer to contact Owner’s Representative (FM Group or Project Manager) for following MANDATORY information to be given to Manufacturer before Manufacturer will issue Manufacturer’s ‘Special LDS Warranty’ included with Closing Submittal:
      1) This must be given to Manufacturer:
         a) Name of Owner (name of FM Group) __________________________
         b) Mailing Address (FM office address) __________________________
         c) Building Property ID (unique 7 digit identifier) _________________
         d) Project site address: _______________________________________
         e) Model Number of each Unit _________________________________
         f) Serial Number of each Unit _________________________________
         g) Date of Installation / Startup ________________________________

2. Qualification Statements:
   a. Technician certificate for use in HFC and HCFC refrigerants.

D. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
   a. Warranty Documentation:
      1) Final, executed copy of Manufacturer’s ‘Special LDS Warranty’ including required Owner / Manufacturer mandatory information.
   b. Record Documentation:
      1) Manufacturers Documentation:
         a) Equipment checkout sheet: Complete and sign all items for each unit.
The Church of Jesus Christ of Latter-day Saints  
Garden City Assembly Hall

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Each unit shall be UL / ULC or ETL labeled.
   3. Refrigeration compressor, coils, and specialties shall be designed to operate with CFC-free refrigerants.

B. Qualifications. Section 01 4301 applies, but is not limited to the following:
   1. Installer: Refrigerant piping shall be installed by refrigeration contractor licensed by State and by technicians certified in use of HFC and HCFC refrigerants.

1.5 WARRANTY

A. Manufacturer’s Warranty:
   1. Provide Manufacturer’s ‘Special LDS Warranty’ for the following:
      a. Provide ten (10) year limited warranty on compressor.
      b. Provide five (5) year limited warranty on parts from date of ‘start-up’.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
   1. Manufacturer Contact List:
         1) Blair Halverson (801) 295-2529.
      b. Carrier Corporation:
         2) Carrier Utah: Bret Adams (Contractors HVAC Supply) (801) 224-1020 ext. 2527 bret.adams@chcsut.com.
      c. Lennox Industries:
         1) For pricing and information call Lennox National Account at (800) 367-6285.
         2) Lennox National Contact: Cody Jackson (801) 736-8904 Cody.Jackson@LennoxInd.com.
      d. York International:
         1) Brian Michael (405) 419-6230 brian.k.michael@jci.com.

B. Performance:
   1. Capacities: SEER rating as defined by AHRI shall be 13.0 or greater.

C. Manufactured Units:
   1. Compressor Units (5 Tons or Less):
      a. General:
         1) Units shall be operable down to 0 deg F (minus 18 deg C) outdoor temperature.
         2) Use R-410a refrigerant.
         3) Only one liquid line, one suction line, and one power connection shall be made to each compressor. Provide charging valves.
      b. Condenser Coils:
         1) Aluminum plate fins mechanically bonded to seamless copper tubes or ‘Spine Fin’ trade mark system which has aluminum fins epoxy bonded to aluminum tubes or micro-channel.
         2) Provide stamped louver coil guard for unit.
      c. Fans:
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

1) Direct driven propeller type.
2) Fan motor shall be single or two speed, thermostatically controlled, permanently lubricated, and designed with permanent protection.
3) Motors shall be resiliently mounted.
4) Each fan shall have a safety guard.

d. Compressor:
   1) Each condenser unit shall have only one compressor.
   2) Design with following features:
      a) Externally mounted brass service valves with charging connections.
      b) Crankcase heater.
      c) Resilient rubber mounts.
      d) Compressor motor-overload protection.
      e) Single speed.

e. Controls:
   1) Factory wired and located in separate enclosure.
   2) Following three paragraphs may not be factory installed and will therefore have to be field installed.
   3) Safety devices:
      a) High and low pressure cutout.
      b) Condenser fan motor-overload devices.
   4) Anti-cycle timers to prevent units from starting up again for five minutes after any power interruption.
   5) Head pressure type low ambient kit.

e. Casing:
   1) Fully weatherproof for outdoor installation. Finish shall be weather resistant.

g. Openings shall be provided for power and refrigerant connections.
h. Panels shall be removable for servicing.
i. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
   1) North Region:
      a) Carrier: 24ABB3.
      b) Lennox: 13ACXN.
      c) York: YCD.

2.2 ACCESSORIES

A. Vibration Isolators:
   1. 4 inches (100 mm) square by 3/4 inch (19 mm) thick minimum neoprene type vibration isolation pads.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
   1. Verify blocking installed under roof decking is in correct location to attach ‘compressor unit curb’.
   2. Notify Architect of unsuitable conditions in writing
   3. Commencement of Work by Installer is considered acceptance of substrate.

3.2 INSTALLATION

A. General:
   1. Set compressor units level on concrete slab on vibration isolation pads located at each corner of unit. This does not apply to compressor units that have composite non-metal bottom.
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

2. Compressor unit to be anchored solidly to concrete slab.
3. Do not use capillary tube and piston type refrigerant metering devices.

3.3 FIELD QUALITY CONTROL

A. Manufacturer Services:
   1. Compressor units shall be started up, checked out, and adjusted by compressor unit Installer.
   2. Use equipment checkout sheet provided by Manufacturer:
      a. Complete and sign all items on sheet.

   END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. DX air coils as described in Contract Documents.

B. Related Requirements:
   1. Section 23 0501: ‘Common HVAC Requirements’.
   2. Section 23 2300: ‘Refrigerant Piping’.
   3. Section 23 8219: ‘Fan Coil Units’.

1.2 REFERENCES

A. Definitions:
   1. DX (Direct Expansion): Use of refrigerant directly expanded into evaporation coils in supply air stream of an air conditioning unit.
   2. Refrigerant: Absorbs heat by a change of state (evaporation) from liquid to a gas, and releases heat by a change of state (condenses) from gas back to a liquid.

B. Reference Standards:
   2. American National Standards Institute / American Society of Heating, Refrigerating and Air-
      Conditioning Engineers:
1.3 SUBMITTALS

A. Informational Submittals:
   1. Manufacturer Reports:
      a. Equipment check-out sheets.

B. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Manufacturers Documentation:
            a) Equipment checkout sheet: Complete and sign all items for each unit.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. DX Coils:
         1) AHRI Certified.
      b. American National Standards Institute / Air-Conditioning, Heating, and Refrigeration Institute
         1) Comply with requirements of ANSI/AHRI Standard 210/240.
      c. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
         1) Comply with requirements of ANSI/ASHRAE Standard 62.1, Section 5, ‘Systems and Equipment’ and Section 7, ‘Construction and Startup’.
      d. Underwriters Laboratories / Underwriters Laboratories of Canada:
         1) Each unit shall be UL / ULC or ETL labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer:
   1. Manufacturer Contact List:
      a. Carrier Corporation:
         1) Carrier National: Bradley Brunner (270) 282-1241 Bradley.M.Brunner@Carrier.utc.com
         2) Carrier Utah: Bret Adams (Contractors HVAC Supply) (801) 224-1020 ext. 2527 bret.adams@chcsut.com
      b. Lennox Industries:
         1) For pricing and information call Lennox National Account at 1-800-367-6285.
         2) Lennox National Contact: Cory Hickens (951) 332-3658 cory.hicken@LennoxInd.com
      c. York International: David E. Carey 405-419-6536 david.e.carey@jci.com

2.2 MANUFACTURED UNITS

A. DX Coils:
   1. Cooling coil shall consist of heavy gauge steel cabinet with baked-on enamel finish to match air handler.
      a. Coil shall have aluminum fins bonded to seamless copper tubing.
      b. Comply with ANSI/AHRI Standard 210/240. Provide drain pans with connections at one end.
c. Use thermal expansion valve with brazed joints in place of capillary tube metering device. Compression fittings not acceptable.

2. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
   a. Horizontal:
      1) Carrier: CNPHP.
      2) Lennox: CH33.
      3) York: MC.
   b. Vertical:
      1) Carrier: CNPVP.
      2) Lennox: CH34.
      3) York: FC.

PART 3 - EXECUTION

3.1 INSTALLATION

   A. Install DX Coil to associated air handler per Manufacturer's recommendations.

END OF SECTION
SECTION 23 8333
ELECTRIC RADIANT HEATERS

PART 1 - GENERAL

1.1 SUMMARY
A. Includes But Not Limited To:
   1. Furnish and install wall heaters as described in Contract Documents.
B. Related Requirements:
   1. Section 23 0501: 'Common HVAC Requirements'.
   2. Section 23 0933: 'Electric and Electronic Control System for HVAC'.
   3. Division 26: Electrical service and connections.

1.2 QUALITY ASSURANCE
A. Regulatory Agency Sustainability Approvals:
   1. Units shall be UL listed and comply with NEC.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS
A. Manufacturers:
   1. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
B. Wall Heaters:
1. Recessed mounting.
2. Sheet metal casing.
3. Heating element shall be encased in steel finned casting and protected by thermal switch.
4. Fan motor shall be permanently lubricated and dust protected bearings.
5. Fan shall be vibration free.
6. Units shall be controlled automatically by external thermostat provided as specified in Section 23 0933 'Electric and Electronic Control System for HVAC'.
7. UL listed.
8. Open coil element or enclosed in steel casing.
9. Thermal cutout with indicator light and one time thermal fuse.
10. Finish: Baked-on enamel.
11. Design Standard. Q Mark CHW3508F (4.8KW) controller used with these plans can only handle 25 amps.

PART 3 - EXECUTION: Not Used

END OF SECTION
DIVISION 26 – ELECTRICAL

26 0519  Low-voltage Electrical Power Conductors And Cables
26 0526  Grounding And Bonding For Electrical Systems
2 60529  Hangers And Supports For Electrical Systems
26 0533  Raceways And Boxes For Electrical Systems
26 0544  Sleeves And Sleeve Seals For Electrical Raceways And Cabling
260548  Vibration And Seismic Controls For Electrical Systems
26 0553  Identification For Electrical Systems
26 0923  Lighting Control Devices
26 0943  Relay-based Lighting Controls
26 2416  Panelboards
26 2713  Electricity Metering
26 2726  Wiring Devices
26 4113  Lightning Protection for Structures
26 2816  Enclosed Switches and Circuit Breakers
26 2913  Enclosed Controllers
26 5100  Interior Lighting
26 5600  Exterior Lighting
26 8313  Roof Snow Melt and Gutter De-Icing

END OF TABLE OF CONTENTS
SECTION 26 0519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL
1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary
   Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:
   1. Section 27 1500 "Communications Horizontal Cabling" for cabling used for voice and
data circuits.

1.3 QUALITY ASSURANCE

PART 2 - PRODUCTS
2.1 CONDUCTORS AND CABLES
A. Aluminum and Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2
   Type and XHHW-2.
C. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable,
   Type MC and Type SOW with ground wire.

2.2 CONNECTORS AND SPLICES
A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type,
   and class for application and service indicated.

2.3 SYSTEM DESCRIPTION
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70,
   by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION
3.1 CONDUCTOR MATERIAL APPLICATIONS
A. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4
   AWG and larger. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and
   larger.
B. Branch Circuits: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8
   AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND
   WIRING METHODS
A. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway or Type XHHW-2,
   single conductors in raceway.
B. Feeders: Type THHN-2-THWN-2, single conductors in raceway or Type XHHW-2, single
   conductors in raceway.
C. Exposed Branch Circuits, Including in Crawlspace: Type THHN-2-THWN-2, single conductors
   in raceway.
D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single
   conductors in raceway or Metal-clad cable, Type MC.
E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type
   THHN-2-THWN-2, single conductors in raceway.
F. Cord Drops and Portable Appliance Connections: Type SOW, hard service cord with stainless-
   steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES
A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
B. Complete raceway installation between conductor and cable termination points according to
   Section 26 0533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and
   cables.
C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 26 0529 "Hangers and Supports for Electrical Systems."

G. Complete cable tray systems installation according to Section 26 0536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
   1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 26 0553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 07 8413 "Penetration Firestopping."

END OF SECTION
SECTION 26 0526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes grounding and bonding systems and equipment.

1.3 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS
A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
B. Bare Copper Conductors:
   4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
   5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
   6. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.3 CONNECTORS
A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.4 GROUNDING ELECTRODES
A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).

PART 3 - EXECUTION

3.1 APPLICATIONS
A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
C. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
   3. Connections to Ground Rods at Test Wells: Bolted connectors.
3.2 **GROUNDING AT THE SERVICE**
   A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 **GROUNDING SEPARATELY DERIVED SYSTEMS**
   A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 **EQUIPMENT GROUNDING**
   A. Install insulated equipment grounding conductors with all feeders and branch circuits.
   B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
   C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
   D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
   E. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.
   F. Metallic Fences: Comply with requirements of IEEE C2.
      1. Grounding Conductor: Bare copper, not less than No. 8 AWG.
      2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
      3. Barbed Wire: Strands shall be bonded to the grounding conductor.

3.5 **INSTALLATION**
   A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
   B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
      1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
      2. For grounding electrode system, install at least three rods spaced at least one rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
   C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
      1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
      2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
      3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
   D. Grounding and Bonding for Piping:
      1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
      2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

G. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.
   1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
   2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

END OF SECTION
SECTION 26 0529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL
1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary
      Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. This Section includes the following:
      1. Hangers and supports for electrical equipment and systems.
   B. Related Sections include the following:
      1. Section 26 0548 "Vibration and Seismic Controls for Electrical Systems" for products and
         installation requirements necessary for compliance with seismic criteria.

1.3 PERFORMANCE REQUIREMENTS
   A. Design supports for multiple raceways capable of supporting combined weight of supported
      systems and its contents.
   B. Design equipment supports capable of supporting combined operating weight of supported
      equipment and connected systems and components.
   C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads
      calculated or imposed for this Project, with a minimum structural safety factor of five times
      the applied force.

1.4 QUALITY ASSURANCE
   A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding
      Code - Steel."
   B. Comply with NFPA 70.

1.5 COORDINATION
   A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete,
      reinforcement, and formwork requirements are specified together with concrete Specifications.
   B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items
      are specified in Section 07 7200 "Roof Accessories."

PART 2 - PRODUCTS
2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS
   A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field
      assembly.
      1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
      2. Channel Dimensions: Selected for applicable load criteria.
   B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
   C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed
      for types and sizes of raceway or cable to be supported.
   D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates,
      shapes, and bars; black and galvanized.
   E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their
      supports to building surfaces include the following:
      1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement
         concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for
         supported loads and building materials where used.
      2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel or Aluminum, for use
         in hardened portland cement concrete with tension, shear, and pullout capacities
         appropriate for supported loads and building materials in which used.
      3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS
         Type 18; complying with MFMA-4 or MSS SP-58.
      4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for
         attached structural element.
      5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
      6. Toggle Bolts: All-steel springhead type.
2.2  FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES
A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
B. Materials: Comply with requirements in Section 05 5000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1  APPLICATION
A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
1. Secure raceways and cables to these supports with single-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.
D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2  SUPPORT INSTALLATION
A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and RMC may be supported by openings through structure members, as permitted in NFPA 70.
C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts or Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3  INSTALLATION OF FABRICATED METAL SUPPORTS
A. Comply with installation requirements in Section 05 5000 "Metal Fabrications" for site-fabricated metal supports.
B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
C. Field Welding: Comply with AWS D1.1/D1.1M.
END OF SECTION
SECTION 26 0533
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
5. Handholes and boxes for exterior underground cabling.
B. Related Requirements:
1. Section 27 0528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

1.3 DEFINITIONS
A. ARC: Aluminum rigid conduit.
B. GRC: Galvanized rigid steel conduit.
C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS
A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS
A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. GRC: Comply with ANSI C80.1 and UL 6.
C. ARC: Comply with ANSI C80.5 and UL 6A.
D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
   1. Comply with NEMA RN 1.
   2. Coating Thickness: 0.040 inch (1 mm), minimum.
E. EMT: Comply with ANSI C80.3 and UL 797.
F. FMC: Comply with UL 1; zinc-coated steel or aluminum.
G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
   1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
   2. Fittings for EMT:
      a. Material: Steel.
      b. Type: Setscrew or compression.
   3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
   4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS
A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
C. Continuous HDPE: Comply with UL 651B.
D. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS
A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1, Type 3R, Type 4, or Type 12 unless otherwise indicated, and sized according to NFPA 70.
   1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
C. Wireway Covers: Flanged-and-gasketed type unless otherwise indicated.
D. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS
A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hubbell Incorporated.
      b. Wiremold / Legrand.

2.5 BOXES, ENCLOSURES, AND CABINETS
A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
D. Metal Floor Boxes:
   2. Type: Fully adjustable.
   3. Shape: Rectangular.
   4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).
J. Gangable boxes are prohibited.
K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type as required for installed location with continuous-hinge cover with flush latch unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
L. Cabinets:
1. NEMA 250, Type as required for installed location galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### 2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

**A. General Requirements for Handholes and Boxes:**
1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

**B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover:** Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC:.
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

### 2.7 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

**A. Handhole and Pull-Box Prototype Test:** Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

### PART 3 - EXECUTION

#### 3.1 RACEWAY APPLICATION

**A. Outdoors:** Apply raceway products as specified below unless otherwise indicated:
1. Aboveground: GRC.
2. Underground Conduit: RNC, Type EPC-40-PVC or Type EPC-80-PVC.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

**B. Indoors:** Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Physical Damage: EMT.
3. Exposed and Subject to Physical Damage: GRC. Raceway locations include the following:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms.
   d. Garages
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches (300 mm) of enclosures to which attached.

I. Raceways Embedded in Slabs:
1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m)intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from RNC to GRC before rising above floor.

J. Stub-ups to Above Recessed Ceilings:
1. Use EMT or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

Q. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

S. Surface Raceways:
1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

T. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

W. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
   c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and
contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.

4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

X. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations.

Y. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.

Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

BB. Locate boxes so that cover or plate will not span different building finishes.

CC. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

EE. Set metal floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 31 2000 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.

2. Install backfill as specified in Section 31 2000 "Earth Moving."

3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 31 2000 "Earth Moving."

4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.

b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

5. Underground Warning Tape: Comply with requirements in Section 26 0553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDBOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION
SECTION 26 0544
SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
   1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
   2. Sleeve-seal systems.
   5. Silicone sealants.

PART 2 - PRODUCTS

2.1 SLEEVES
A. Wall Sleeves:
   2. Cast-Iron Pipe Sleeves: Cast or fabricated “wall pipe,” equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
C. Sleeves for Rectangular Openings:
   2. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
      b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS
A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Advance Products & Systems, Inc.
      b. CALPICO, Inc.
      c. Metraflex Company (The).
      d. Pipeline Seal and Insulator, Inc.
      e. Proco Products, Inc.
   2. Sealing Elements: EPDM or Nitrile (Buna N) rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   3. Pressure Plates: Carbon steel or Stainless steel.
   4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS
A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Presealed Systems.
2.4 **GROUT**
   A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
   C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
   D. Packaging: Premixed and factory packaged.

2.5 **SILICONE SEALANTS**
   A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
      1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
      2. Sealant shall comply with the testing and product requirements of the California Department of Health Services’ “Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.”
   B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 **SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS**
   A. Comply with NECA 1.
   B. Comply with NEMA VE 2 for cable tray and cable penetrations.
   C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
      1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
         a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
         b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
      2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
      3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
      4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
      5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.
   D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
      1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
      2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
   E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
   F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 **SLEEVE-SEAL-SYSTEM INSTALLATION**
   A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
   B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical
sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
C. Secure nailing flanges to concrete forms.
D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION
SECTION 26 0548
VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes the following:
   1. Isolation pads.
   2. Channel support systems.
   3. Restraint cables.
   4. Hanger rod stiffeners.
   5. Anchorage bushings and washers.
B. Related Sections include the following:
   1. Division 26 Section "Hangers And Supports For Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 DEFINITIONS
C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS
A. Seismic-Restraint Loading:
   1. Site Class as Defined in the IBC: D.
   2. Site Class as Defined in the IBC: D.
   3. Assigned Seismic Use Group or Building Category as Defined in the IBC: IV.
      a. Component Importance Factor:
         1) General: 1.0.
         2) Life Safety (EM): 1.5
      b. Component Response Modification Factor:
         1) Fixtures: 1.5
         2) Equipment: 2.5
         3) Conduit and Cables: 5.0.
      c. Component Amplification Factor: 2.5.
   4. Design Spectral Response Acceleration at Short Periods (0.2 Second): 173%.
   5. Design Spectral Response Acceleration at 1.0-Second Period: 76%.

1.5 QUALITY ASSURANCE
A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SEISMIC-RESTRAINT DEVICES
A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Amber/Booth Company, Inc.
   2. California Dynamics Corporation.
   3. Cooper B-Line, Inc.; a division of Cooper Industries.
   4. Hilti Inc.
5. Loos & Co.; Seismic Earthquake Division.
7. TOLCO Incorporated; a brand of NIBCO INC.
8. Unistrut; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
   1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables: ASTM A 603 galvanized or ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod. Do not weld stiffeners to rods.

F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.

G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.

H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.2 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
   1. Powder coating on springs and housings.
   2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
   3. Baked enamel or powder coat for metal components on isolators for interior use.
   4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints:
   1. Install restrained isolators on electrical equipment.
   2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
   3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

D. Drilled-in Anchors:
   1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
   2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
   3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
   4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
   5. Set anchors to manufacturer's recommended torque, using a torque wrench.
   6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
   2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
   4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
   5. Test to 90 percent of rated proof load of device.
   7. Measure isolator deflection.
   8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
C. Remove and replace malfunctioning units and retest as specified above.
D. Prepare test and inspection reports.

3.6 ADJUSTING
A. Adjust isolators after isolated equipment is at operating weight.
B. Adjust active height of spring isolators.
C. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION
SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL
1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
1. Identification for conductors.
2. Underground-line warning tape.
3. Warning labels and signs.
4. Instruction signs.
5. Equipment identification labels.

1.3 ACTION SUBMITTALS
A. Product Data: For each electrical identification product indicated.
B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE
A. Comply with ANSI A13.1.
B. Comply with NFPA 70.
D. Comply with ANSI Z535.4 for safety signs and labels.
E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION
A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
C. Coordinate installation of identifying devices with location of access panels and doors.
D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS
2.1 CONDUCTOR IDENTIFICATION MATERIALS
A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 0.08 mm (3 mils) thick by 25 to 50 mm (1 to 2 inches) wide.
B. Self-Adhesive, Self-Laminating Polyester Labels: Write-on, 0.08-mm- (3-mil-) thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.
C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 FLOOR MARKING TAPE
A. 50-mm- (2-inch-) wide, 0.125-mm (5-mil) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.3 UNDERGROUND-LINE WARNING TAPE
A. Tape:
1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
B. Color and Printing:
   1. Comply with ANSI Z535.1 through ANSI Z535.5.
   2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE,
   3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE,
      COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.4 WARNING LABELS AND SIGNS
B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels,
   configured for display on front cover, door, or other access to equipment unless otherwise
   indicated.
C. Warning label and sign shall include, but are not limited to, the following legends:
   1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT
      OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 915 MM (36 INCHES)."
   2. Arc Flash Hazard Warning: Manufacturer’s standard.

2.5 INSTRUCTION SIGNS
A. Engraved, laminated acrylic or melamine plastic, minimum 1.6 mm (1/16 inch) thick for signs up
   to 129 sq. cm (20 sq. inches) and 3.2 mm (1/8 inch) thick for larger sizes.
   1. Engraved legend with black letters on white face.
   2. Punched or drilled for mechanical fasteners.

2.6 EQUIPMENT IDENTIFICATION LABELS
A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white
   letters on a dark-gray background. Minimum letter height shall be 10 mm (3/8 inch).
   1. Minimum Width: 5 mm (3/16 inch).
   2. Tensile Strength at 23 deg C (73 deg F), According to ASTM D 638: 82.7 MPa (12,000
      psi).
   3. Temperature Range: Minus 40 to plus 85 deg C (Minus 40 to plus 185 deg F).
B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight,
   self extinguishing, one piece, self locking, Type 6/6 nylon.
   1. Minimum Width: 5 mm (3/16 inch).
   2. Tensile Strength at 23 deg C (73 deg F), According to ASTM D 638: 82.7 MPa (12,000
      psi).
   3. Temperature Range: Minus 40 to plus 85 deg C (Minus 40 to plus 185 deg F).
C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
   1. Minimum Width: 5 mm (3/16 inch).
   2. Tensile Strength at 23 deg C (73 deg F), According to ASTM D 638: 48.2 MPa (7000
      psi).
   3. UL 94 Flame Rating: 94V-0.
   4. Temperature Range: Minus 46 to plus 140 deg C (Minus 50 to plus 284 deg F).
   5. Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS
A. Paint: Comply with requirements in painting Sections for paint materials and application
   requirements. Select paint system applicable for surface material and location (exterior or
   interior).
B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine
   screws with nuts and flat and lock washers.

PART 3 - EXECUTION
3.1 INSTALLATION
A. Verify identity of each item before installing identification products.
The Church of Jesus Christ of Latter Day Saints
Garden City Assembly Hall

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
C. Apply identification devices to surfaces that require finish after completing finish work.
D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
F. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.
G. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 15-m (50-foot) maximum intervals in straight runs, and at 7.6-m (25-foot) maximum intervals in congested areas.
H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
I. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
   1. Outdoors: UV-stabilized nylon.
   2. In Spaces Handling Environmental Air: Plenum rated.
J. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 150 to 200 mm (6 to 8 inches) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 400 mm (16 inches) overall.
K. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE
A. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
   2. Power.
   3. UPS.
B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
   1. Color-Coding for Phase Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
      a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
      b. Colors for 208/120-V Circuits:
         1) Phase A: Black
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Neutral: White with colored stripe to match associated phase
         5) Ground: Green
         6) Isolated Ground: Green with continuous yellow stripe
      c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 150 mm (6 inches) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
C. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.
D. Control-Circuit Conductor Termination Identification: For identification at terminations provide self-adhesive vinyl labels with the conductor designation.
E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
   2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
   1. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
   2. Identify system voltage with black letters on an orange background.
   3. Apply to exterior of door, cover, or other access.

J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
   1. Labeling Instructions:
      a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 13-mm- (1/2-inch-) high letters on 38-mm- (1-1/2-inch-) high label; where two lines of text are required, use labels 50 mm (2 inches) high.
      b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
      c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
      d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
   2. Equipment to Be Labeled:
      a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
      b. Enclosures and electrical cabinets.
      c. Access doors and panels for concealed electrical items.
      d. Enclosed switches.
      e. Enclosed circuit breakers.
      f. Enclosed controllers.
      g. Push-button stations.
      h. Contactors.
      i. Remote-controlled switches, dimmer modules, and control devices.
      j. UPS equipment.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
   1. Photoelectric switches.
   2. Standalone daylight-harvesting switching controls.
   3. Indoor occupancy sensors.

B. Related Requirements:

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Shop Drawings: Show installation details for occupancy and light-level sensors.
   1. Interconnection diagrams showing field-installed wiring.
   2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS
A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 OUTDOOR PHOTOELECTRIC SWITCHES
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   1. Cooper Industries, Inc.
   2. Intermatic, Inc.
   3. NSi Industries LLC; TORK Products.
   4. Tyco Electronics; ALR Brand.

B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
   3. Time Delay: Fifteen second minimum, to prevent false operation.
   5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.2 DAYLIGHT-HARVESTING DIMMING CONTROLS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cooper Industries, Inc.
   2. Crestron.
   3. Douglass Lighting Controls.
   4. Hubbell Building Automation, Inc.
   5. Leviton Manufacturing Co., Inc.
   6. Lithonia Lighting; Acuity Brands Lighting, Inc.
   7. Lutron Electronics Co., Inc.
   8. WattStopper; a Legrand® Group brand.
B. System Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, the lights are dimmed.
   1. Lighting control set point is based on two lighting conditions:
      a. When no daylight is present (target level).
      b. When significant daylight is present.
   2. System programming is done with two hand-held, remote-control tools.
      a. Initial setup tool.
      b. Tool for occupants to adjust the target levels by increasing the set point up to 25 percent, or by minimizing the electric lighting level.
C. Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit, with separate controller unit, to detect changes in lighting levels that are perceived by the eye.
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Sensor Output: 0- to 10-V dc to operate electronic dimming ballasts. Sensor is powered by controller unit.
   3. Power Pack: Sensor has 24-V dc, Class 2 power source, as defined by NFPA 70.
   4. Light-Level Sensor Set-Point Adjustment Range: 20 to 60 fc (120 to 640 lux).

2.3 INDOOR OCCUPANCY SENSORS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cooper Industries, Inc.
   2. Hubbell Building Automation, Inc.
   4. Lightolier Controls.
   5. Lithonia Lighting; Acuity Lighting Group, Inc.
   7. Sensor Switch, Inc.
   8. Square D; a brand of Schneider Electric.
B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
   3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
   4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
   5. Mounting:
      a. Sensor: Suitable for mounting in any position on a standard outlet box.
      b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
      c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
   6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
   7. Bypass Switch: Override the "on" function in case of sensor failure.
   8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.
C. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.
   1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling.

D. Ultrasonic Type: Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy.
   1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
   2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
   3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
   4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
   5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).

E. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
   1. Sensitivity Adjustment: Separate for each sensing technology.
   2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
   3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2.4 SWITCHBOX-MOUNTED OCCUPANCY SENSORS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cooper Industries, Inc.
   2. Hubbell Building Automation, Inc.
   4. Lightolier Controls.
   5. Lithonia Lighting; Acuity Lighting Group, Inc.
   7. Sensor Switch, Inc.
   8. Square D; a brand of Schneider Electric.
B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
   3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.

2.5 CONDUCTORS AND CABLES
A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."
   B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 22 AWG. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."
C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 16 AWG. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION
A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION
A. Wiring Method: Comply with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).
B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION
A. Identify components and power and control wiring according to Section 26 0553 "Identification for Electrical Systems."
   1. Identify controlled circuits in lighting contactors.
   2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL
A. Perform the following tests and inspections:
   1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
B. Lighting control devices will be considered defective if they do not pass tests and inspections.
C. Prepare test and inspection reports.

3.5 ADJUSTING
A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
   1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
   2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.

3.6 DEMONSTRATION
A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Section 26 0943.13 "Addressable-Fixture Lighting Controls" and Section 26 0943.23 "Relay-Based Lighting Controls."
B. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION
PART 1 - GENERAL
1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary
   Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes: Networked lighting control panels using control-voltage relays for switching.

1.3 DEFINITIONS
A. Monitoring: Acquisition, processing, communication, and display of equipment status data,
   metered electrical parameter values, power quality evaluation data, event and alarm signals,
   tabulated reports, and event logs.
B. PC: Personal computer; sometimes plural as "PCs."
C. RS-485: A serial network protocol, similar to RS-232, complying with TIA-485-A.

1.4 ACTION SUBMITTALS
A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components
      and profiles, and finishes for control modules, power distribution components, relays,
      manual switches and plates, and conductors and cables.
   2. Include rated capacities, operating characteristics, electrical characteristics, and
      furnished specialties and accessories.
B. Shop Drawings: For each relay panel and related equipment.
   1. Include dimensioned plans, elevations, sections, and details. Show tabulations of
      installed devices, equipment features, and ratings.
   2. Detail enclosure types and details for types other than NEMA 250, Type 1.
   3. Detail wiring partition configuration, current, and voltage ratings.
   4. Short-circuit current rating of relays.
   5. Include diagrams for power, signal, and control wiring.
   6. Block Diagram: Show interconnections between components specified in this Section
      and devices furnished with power distribution system components. Indicate data
      communication paths and identify networks, data buses, data gateways, concentrators,
      and other devices to be used. Describe characteristics of network and other data
      communication lines.

1.5 INFORMATIONAL SUBMITTALS
A. Coordination Drawings: Submit evidence that lighting controls are compatible with connected
   monitoring and control devices and systems specified in other Sections.
   1. Show interconnecting signal and control wiring, and interface devices that prove
      compatibility of inputs and outputs.
   2. For networked controls, list network protocols and provide statements from
      manufacturers that input and output devices comply with interoperability requirements of
      the network protocol.
B. Software licenses and upgrades required by and installed for operation and programming of
   digital and analog devices.

1.6 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and
   maintenance manuals.
B. Software and Firmware Operational Documentation:
   1. Software operating and upgrade manuals.
   2. Program Software Backup: On magnetic media or compact disk, complete with data
      files.
   3. Device address list.
   4. Printout of software application and graphic screens.

1.7 MAINTENANCE MATERIAL SUBMITTALS
A. Furnish extra materials that match products installed and that are packaged with protective
   covering for storage and identified with labels describing contents.
1. Lighting Control Relays: Equal to ten percent of amount installed for each size indicated, but no fewer than three.

1.8 DELIVERY, STORAGE, AND HANDLING
A. Handle and prepare panels for installation according to NECA 407.

PART 2 - PRODUCTS
2.1 SYSTEM DESCRIPTION
A. Input signal from field-mounted manual switches, or digital signal sources, shall open or close one or more lighting control relays in the lighting control panels. Any combination of inputs shall be programmable to any number of control relays.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
C. Comply with 47 CFR, Subparts A and B, for Class A digital devices.
D. Comply with UL 916.

2.2 PERFORMANCE REQUIREMENTS
A. Seismic Performance: Lighting control panels shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified."
   2. Component Importance Factor: 1.5.

2.3 NETWORKED LIGHTING CONTROL PANELS
A. Products: Subject to compliance with requirements, provide one of the following:
   1. Cooper Greengate
   2. Crestron
   3. Douglass
   5. Lighting Control & Design, Inc.
   6. Lightolier Controls; a Genlyte Company.
   7. Lutron Electronics Company, Inc.
   9. Watt Stopper (The).
B. Description: Lighting control panels using mechanically latched relays to control lighting and appliances. The panels shall be capable of being interconnected with digital communications to appear to the operator as a single lighting control system.
C. Lighting Control Panels:
   1. A single enclosure with incoming lighting branch circuits, control circuits, switching relays, and on-board timing and control unit.
   2. A vertical barrier separating branch circuits from control wiring.
D. Main Control Unit: Installed in the main lighting control panel only; powered from the branch circuit of the standard control unit.
   1. Ethernet Communications: Comply with MS Windows TCP/IP protocol. The main control unit shall provide for programming of all control functions of the main and all networked slave lighting control panels including timing, sequencing, and overriding.
   2. Compliance with ASHRAE 135: Controllers shall support serial MS/TP and Ethernet IP communications, and shall be able to communicate directly via BAS RS-485 serial networks and Ethernet 10Base-T networks as a native device.
   3. Web Server: Display information listed below over a standard Web-enabled server for displaying information over a standard browser.
      a. A secure, password-protected login screen for modifying operational parameters, accessible to authorized users via Web page interface.
      b. Panel summary showing the master and slave panels connected to the controller.
      c. Controller diagnostic information.
      d. Show front panel mimic screens for setting up controller parameters, input types, zones, and operating schedules. These mimic screens shall also allow direct breaker control and zone overrides.
   4. Timing Unit:
a. 365-day calendar, astronomical clock, and automatic adjustments for daylight savings and leap year.
b. Clock configurable for 12-hour (A.M./P.M.) or 24-hour format.
c. Four independent schedules, each having 24 time periods.
d. Schedule periods settable to the minute.
e. Day-of-week, day-of-month, day-of-year with one-time or repeating capability.
f. 16 special date periods.

5. Time Synchronization: The timing unit shall be updated not less than every hour(s) with the network time server.

6. Sequencing Control with Override:
   a. Automatic sequenced on and off switching of selected relays at times set at the timing unit, allowing timed overrides from external switches.
   b. Sequencing control shall operate relays one at a time, completing the operation of all connected relays in not more than 10 seconds.
   c. Override control shall allow any relay connected to it to be switched on or off by a field-deployed manual switch or by an automatic switch, such as an occupancy sensor.
   d. Override control “blinking warning” shall warn occupants approximately five minutes before actuating the off sequence.
   e. Activity log, storing previous relay operation, including the time and cause of the change of status.
   f. Download firmware to the latest version offered by manufacturer.

E. Standard Control Unit, Installed in All Lighting Control Panels: Contain electronic controls for programming the operation of the relays in the control panel, contain the status of relays, and contain communications link to enable the digital functions of the main control unit. Comply with UL 916.
   1. Electronic control for operating and monitoring individual relays, and display relay on-time.
   2. Nonvolatile memory shall retain all setup configurations. After a power failure, the controller shall automatically reboot and return to normal system operation.

F. Operator Interface:
   1. Integral touchscreen keypad and digital display, and intuitive menus to assist in programming.
   2. Log and display relay on-time.
   3. Connect relays to one or more time and sequencing schemes.
   4. Blink notice, time adjustable from software.
   5. Ability to log and display relay on-time.
   6. Capability for accepting downloadable firmware so that the latest production features may be added in the future without replacing the module.

G. Relays: Electrically operated, mechanically held single-pole switch, rated at 20 A at 120-V tungsten, 30 A at 277-V ballast, 1.5 hp at 120 V, and 3 hp at 277 V. Short-circuit current rating shall be not less than 14 kA. Control shall be digital control network.

H. Power Supply: NFPA 70, Class 2, UL listed, sized for connected equipment, plus not less than 20 percent spare capacity. Powered from a dedicated branch circuit of the panelboard that supplies power to the line side of the relays, sized to provide control power for the local panel-mounted relays, bus system, low-voltage inputs, field-installed occupancy sensors, and low-voltage photo sensors.

I. Operator Interface: At the main control unit, provide interface for a tethered connection of a portable PC running MS Windows for configuring all networked lighting control panels using setup software designed for the specified operating system. Include one portable device for initial programming of the system and training of Owner's personnel. That device shall remain the property of Owner.

J. Software:
   1. Menu-driven data entry.
   2. Online and offline programming and editing.
   3. Provide for entry of the room or space designation for the load side of each relay.
4. Monitor and control all relays, showing actual relay state and the name of the automatic actuating control, if any.
5. Size the software appropriate to the system.

2.4 MANUAL SWITCHES AND PLATES
A. Push-Button Switches: Modular, digital type communicating with control panel over digital bus.
   1. Match color specified in Division 26 Section "Wiring Devices."
   2. Integral green LED pilot light to indicate when circuit is on.
   3. Internal white LED locator light to illuminate when circuit is off.
   4. Manufacturers: Compatible with control systems specified. Examples of acceptable switches include, but are not limited to:
      a. Cooper Greengate: Digita series
      b. Leviton: Z-MAX series
      c. LC&D: Chelsea DigitalSwitch
   5. Integral green LED pilot light to indicate when circuit is on.
   6. Internal white LED locator light to illuminate when circuit is off.
B. Wall Plates: Single and multigang plates as specified in Section 26 2726 "Wiring Devices."
   C. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

2.5 FIELD-MOUNTED SIGNAL SOURCES
A. Daylight Harvesting Switching Controls: Comply with Section 26 0923 "Lighting Control Devices." Control power may be taken from the lighting control panel, and signal shall be compatible with the relays.
B. Indoor Occupancy Sensors: Comply with Section 26 0923 "Lighting Control Devices." Control power may be taken from the lighting control panel, and signal shall be compatible with the relays.

2.6 CONDUCTORS AND CABLES
A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."
B. Classes 2 and 3 Control Cables: Multiconductor cable with copper conductors not smaller than No. 22 AWG, complying with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."
C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 16 AWG, complying with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."
D. Digital and Multiplexed Signal Cables: Unshielded, twisted-pair cable with copper conductors, complying with TIA/EIA-568-B.2, Category 5e for horizontal copper cable and with Section 27 1500 "Communications Horizontal Cabling."

PART 3 - EXECUTION
3.1 EXAMINATION
A. Receive, inspect, handle, and store panels according to NECA 407.
B. Examine panels before installation. Reject panels that are damaged or rusted or have been subjected to water saturation.
C. Examine elements and surfaces to receive panels for compliance with installation tolerances and other conditions affecting performance of the Work.
D. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 WIRING INSTALLATION
A. Comply with NECA 1.
B. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
   1. Install plenum cable in environmental air spaces, including plenum ceilings.
   2. Comply with requirements for cable trays specified in Section 26 0536 "Cable Trays for Electrical Systems."
   3. Comply with requirements for raceways and boxes specified in Section 26 0533 "Raceways and Boxes for Electrical Systems."
C. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

### 3.3 PANEL INSTALLATION

A. Comply with NECA 1.

B. Install panels and accessories according to NECA 407.

C. Comply with mounting and anchoring requirements specified in Section 26 0548 "Vibration and Seismic Controls for Electrical Systems."

D. Mount panel cabinet plumb and rigid without distortion of box.

E. Install filler plates in unused spaces.

### 3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 0553 "Identification for Electrical Systems."

C. Create a directory to indicate loads served by each relay; incorporate Owner's final room designations. Obtain approval before installing. Use a PC or typewriter to create directory; handwritten directories are unacceptable.

D. Lighting Control Panel Nameplates: Label each panel with a nameplate complying with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

### 3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Acceptance Testing Preparation:
   1. Test continuity of each circuit.

D. Lighting control panel will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies lighting control panels and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

### 3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.
   2. Confirm correct communications wiring, initiate communications between panels, and program the lighting control system according to approved configuration schedules, time-of-day schedules, and input override assignments.

### 3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

### 3.8 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.9 DEMONSTRATION
   A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the control unit and operator interface.

END OF SECTION
SECTION 26 2416
PANELBOARDS

PART 1 - GENERAL
1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary
      Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section Includes:
      1. Distribution panelboards.
      2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS
   A. SPD: Surge Protective Device

1.4 ACTION SUBMITTALS
   A. Product Data: For each type of panelboard, switching and overcurrent protective device,
      transient voltage suppression device, accessory, and component indicated. Include dimensions
      and manufacturers' technical data on features, performance, electrical characteristics, ratings,
      and finishes.
   B. Shop Drawings: For each panelboard and related equipment.
      1. Include dimensioned plans, elevations, sections, and details. Show tabulations of
         installed devices, equipment features, and ratings.
      2. Detail enclosure types and details for types other than NEMA 250, Type 1.
      3. Detail bus configuration, current, and voltage ratings.
      4. Short-circuit current rating of panelboards and overcurrent protective devices.
      5. Include evidence of NRTL listing for series rating of installed devices.
      6. Detail features, characteristics, ratings, and factory settings of individual overcurrent
         protective devices and auxiliary components.
      7. Include wiring diagrams for power, signal, and control wiring.
      8. Include time-current coordination curves for each type and rating of overcurrent
         protective device included in panelboards. Submit on translucent log-log graft paper;
         include selectable ranges for each type of overcurrent protective device.

1.5 INFORMATIONAL SUBMITTALS
   A. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective
      devices, accessories, and components will withstand seismic forces defined in Section 26 0548.16
      "Seismic Controls for Electrical Systems." Include the following:
         1. Basis for Certification: Indicate whether withstand certification is based on actual test of
            assembled components or on calculation.
         2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate
            and describe mounting and anchorage provisions.
         3. Detailed description of equipment anchorage devices on which the certification is based
            and their installation requirements.
   B. Field Quality-Control Reports:
      1. Test procedures used.
      2. Test results that comply with requirements.
      3. Results of failed tests and corrective action taken to achieve test results that comply with
         requirements.
   C. Panelboard Schedules: For installation in panelboards.

1.6 CLOSEOUT SUBMITTALS
   A. Operation and Maintenance Data: For panelboards and components to include in emergency,
      operation, and maintenance manuals. In addition to items specified in Section 01 7823
      "Operation and Maintenance Data," include the following:
         1. Manufacturer's written instructions for testing and adjusting overcurrent protective
            devices.
         2. Time-current curves, including selectable ranges for each type of overcurrent protective
            device that allows adjustments.
1.7 MAINTENANCE MATERIAL SUBMITTALS
A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.

1.8 QUALITY ASSURANCE
A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
D. Comply with NEMA PB 1.
E. Comply with NFPA 70.

1.9 DELIVERY, STORAGE, AND HANDLING
A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 PROJECT CONDITIONS
A. Environmental Limitations:
1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   a. Ambient Temperature: Not exceeding minus 5 deg C (23 deg F) to plus 40 deg C (plus 104 deg F).
   b. Altitude: Not exceeding 2000 m (6600 feet).
B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
   1. Ambient temperatures within limits specified.
   2. Altitude not exceeding 2000 m (6600 feet).

1.11 COORDINATION
A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

PART 2 - PRODUCTS
2.1 GENERAL REQUIREMENTS FOR PANELBOARDS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
4. Square D; a brand of Schneider Electric.
B. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 26.0548.16 "Seismic Controls for Electrical Systems."
C. Enclosures: Flush- and surface-mounted cabinets.
   1. Rated for environmental conditions at installed location.
   a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Wash-Down Areas: NEMA 250, Type 4X.
d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

3. Finishes:
   a. Panels and Trim: galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.


D. Phase, Neutral, and Ground Buses:
   1. Material: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity.
   2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
   3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.

E. Conductor Connectors: Suitable for use with conductor material and sizes.
   1. Material: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity.
   2. Main and Neutral Lugs: Mechanical type.
   3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
   4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
   5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.


2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

B. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

2.3 DISTRIBUTION PANELBOARDS

A. Panelboards: NEMA PB 1, power and feeder distribution type.
B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
   1. For doors more than 914 mm (36 inches) high, provide two latches, keyed alike.
D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
B. Mains: Circuit breaker or lugs only.
C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
   2. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
   4. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
      a. Standard frame sizes, trip ratings, and number of poles.
      b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
      c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
      d. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
      e. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.
B. Equipment Mounting: Install panelboards on concrete bases, 100-mm (4-inch) nominal thickness. Comply with requirements for concrete base specified in Section 03 3000 "Cast-in-Place Concrete."
   1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 450-mm (18-inch) centers around full perimeter of base.
   2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   4. Install anchor bolts to elevations required for proper attachment to panelboards.
   5. Attach panelboard to the vertical finished or structural surface behind the panelboard.
C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
D. Comply with mounting and anchoring requirements specified in Section 26 0548.16 "Seismic Controls for Electrical Systems."
E. Mount top of trim 2286 mm (90 inches) above finished floor unless otherwise indicated.
F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
G. Install overcurrent protective devices and controllers not already factory installed.
1. Set field-adjustable, circuit-breaker trip ranges.

H. Install filler plates in unused spaces.

I. Stub four 27-GRC (1-inch) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 27-GRC (1-inch) empty conduits into raised floor space or below slab not on grade.

J. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

K. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 0553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner’s final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.4 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated
SECTION 26 2713
ELECTRICITY METERING

PART 1 - GENERAL
1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes equipment for electricity metering by utility company.

1.3 DEFINITIONS

1.4 ACTION SUBMITTALS
A. Product Data: For each type of product indicated.
B. Shop Drawings: For electricity-metering equipment.
   1. Dimensioned plans and sections or elevation layouts.

1.5 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:
   1. Application and operating software documentation.
   2. Software licenses.
   3. Software service agreement.
   4. Hard copies of manufacturer's operating specifications, design user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy Submittal.

1.6 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 DELIVERY, STORAGE, AND HANDLING
A. Receive, store, and handle modular meter center according to NECA 400.

1.8 COORDINATION
A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:
   1. Comply with requirements of utilities providing electrical power services.
   2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

PART 2 - PRODUCTS
2.1 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY
A. Meters will be furnished by utility company.
B. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.
C. Meter Sockets: Comply with requirements of electrical-power utility company.

PART 3 - EXECUTION
3.1 INSTALLATION
A. Comply with equipment installation requirements in NECA 1.
B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

3.2 IDENTIFICATION
A. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
   1. Receptacles, receptacles with integral GFCI, and associated device plates.
   2. Twist-locking receptacles.
   3. Isolated-ground receptacles.
   5. Snap switches and wall-box dimmers.
   6. Pendant cord-connector devices.
   7. Cord and plug sets.
   8. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 DEFINITIONS
A. EMI: Electromagnetic interference.
B. GFCI: Ground-fault circuit interrupter.
C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
D. RFI: Radio-frequency interference.
E. TVSS: Transient voltage surge suppressor.
F. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
   2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
C. Samples: One for each type of device and wall plate specified, in each color specified.

1.6 INFORMATIONAL SUBMITTALS
A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For wiring devices to include in all manufacturers’ packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Manufacturer’s Names: Shortened versions (shown in parentheses) of the following manufacturers’ names are used in other Part 2 articles:
   1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
   2. Hubbell Incorporated; Wiring Device-Kellem's (Hubbell).
B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS
A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Comply with NFPA 70.
C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton
   2. Hubbell Incorporated; Wiring Devices
3. Leviton Manufacturing Company
4. Pass & Seymour/Legrand (Pass & Seymour)

D. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Duplex Receptacles, 125 V, 20 A:
   1. Description: Two pole, three wire, and self-grounding.
   2. Configuration: NEMA WD 6, Configuration 5-20R.
   3. Standards: Comply with UL 498 and FS W-C-596.

B. Tamper-Resistant Duplex Receptacles, 125 V, 20 A:
   1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
   2. Configuration: NEMA WD 6, Configuration 5-20R.
   3. Standards: Comply with UL 498 and FS W-C-596.

C. Tamper- and Weather-Resistant Duplex Receptacles, 125 V, 20 A:
   1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
   2. Configuration: NEMA WD 6, Configuration 5-20R.
   4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.4 USB RECEPTACLES

A. Tamper-Resistant Duplex and USB Charging Receptacles:
   1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Integral shutters that operate only when a plug is inserted in the line voltage receptacle.
   2. Line Voltage Receptacles: Two pole, three wire, and self-grounding; NEMA WD 6, Configuration 5-20R.
   3. USB Receptacles: Dual USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).
   4. Standards: Comply with UL 498, UL 1310, USB 3.0 devices, and FS W-C-596.
   5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

2.5 GFCI RECEPTACLES, 125 V, 20 A

A. Tamper-Resistant Duplex GFCI Receptacles, 125 V, 20 A:
   1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
   2. Configuration: NEMA WD 6, Configuration 5-20R.
   3. Type: Feed through.
   4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
   5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

B. Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A:
   1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
   2. Configuration: NEMA WD 6, Configuration 5-15R.
   3. Type: Feed through.
   4. Standards: Comply with UL 498 and UL 943 Class A.
   5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.
2.6 **TWIST-LOCKING RECEPTACLES**
   A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.

2.7 **PENDANT CORD-CONNECTOR DEVICES**
   A. Description:
      1. Matching, locking-type plug and receptacle body connector.
      2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
      4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.8 **CORD AND PLUG SETS**
   A. Description:
      1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
      2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.

2.9 **LOW VOLTAGE SWITCHES**
   A. Push-Button Switches: Modular, analog interface, for operating one or more relays and to work in conjunction with automatic controls.
      1. Match color and style specified in Section 26 2726 "Wiring Devices."
      2. Integral green LED pilot light to indicate when circuit is on.
      3. Internal white LED locator light to illuminate when circuit is off.
   B. Legend: Engraved or permanently silk-screened on wall plate. Use designations indicating load controlled.
   C. 24-volt; Powered from associated power pack serving controlled switching group

2.10 **LOW VOLTAGE DIMMERS**
   A. Push-Button Dimmer: Modular, analog interface, with up/down dimming control and separate pushbutton on/off control for operating one or more relays and to work in conjunction with automatic controls.
      1. Match color and style specified in Section 26 2726 "Wiring Devices."
      2. Integral green LED pilot light to indicate when circuit is on.
      3. Internal white LED locator light to illuminate when circuit is off.
   B. Legend: Engraved or permanently silk-screened on wall plate. Use designations indicating load controlled.
   C. 24-volt; Powered from associated power pack serving controlled switching group
   D. 0-10V dimming output integrated into switch or associated power pack

2.11 **WALL PLATES**
   A. Single and combination types shall match corresponding wiring devices.
      1. Plate-Securing Screws: Metal with head color to match plate finish.
      4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
   B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum or thermoplastic with lockable cover.

2.12 **FLOOR SERVICE FITTINGS**
   A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
   B. Compartments: Barrier separates power from voice and data communication cabling.
   C. Service Plate: Rectangular, with satin finish.
   D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 jacks for UTP cable complying with requirements in Section 27 1500 "Communications Horizontal Cabling."

2.13 FINISHES
A. Device Color:
1. Wiring Devices Connected to Normal Power System: White or As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Isolated-Ground Receptacles: Orange.
B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION
3.1 INSTALLATION
A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
B. Coordination with Other Trades:
1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.
C. Conductors:
1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.
D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.
F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
G. Dimmers:
1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers’ device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES
A. Install feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION
A. Comply with Section 26 0553 “Identification for Electrical Systems.”

3.4 FIELD QUALITY CONTROL
A. Perform the following tests and inspections:
   1. Test Instruments: Use instruments that comply with UL 1436.
   2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:
   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.
   6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
   1. Nonfusible switches.
   2. Molded-case circuit breakers (MCCBs).
   3. Enclosures.

1.3 DEFINITIONS
A. NC: Normally closed.
B. NO: Normally open.
C. SPDT: Single pole, double throw.

1.4 PERFORMANCE REQUIREMENTS
A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 ACTION SUBMITTALS
A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
   1. Enclosure types and details for types other than NEMA 250, Type 1.
   2. Current and voltage ratings.
   3. Short-circuit current ratings (interrupting and withstand, as appropriate).
   4. Include evidence of NRTL listing for series rating of installed devices.
   5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
   6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.
B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
   1. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS
A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
B. Field quality-control reports.
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.7 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:
   1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.8 QUALITY ASSURANCE
A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.9 PROJECT CONDITIONS
A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).

1.10 COORDINATION
A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Sector; Eaton Corporation.
   2. General Electric Company.
   4. Square D; by Schneider Electric.

2.2 NONFUSIBLE SWITCHES
A. Type GD, General Duty, Single Throw, 600 A and Smaller; UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
B. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
   5. Hookstick Handle: Allows use of a hookstick to operate the handle.
   6. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS
A. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
C. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
D. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
E. Features and Accessories:
   1. Standard frame sizes, trip ratings, and number of poles.
   2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
   3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.

2.4 ENCLOSED SWITCHES
A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
   1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
   2. Outdoor Locations: NEMA 250, Type 3R.
   3. Wash-Down Areas: NEMA 250, Type 4X,
   4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
   5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION
3.1 EXAMINATION
A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION
A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
B. Comply with mounting and anchoring requirements specified in Section 26 0548.16 "Seismic Controls for Electrical Systems."
C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
D. Comply with NECA 1.

3.3 IDENTIFICATION
A. Comply with requirements in Section 26 0553 "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 ADJUSTING
A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION
The Church of Jesus Christ of Latter Day Saints
Garden City Assembly Hall

ENCLOSED SWITCHES AND CIRCUIT BREAKERS
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. Section includes the following enclosed controllers rated 600 V and less:
      1. Full-voltage manual.
      2. Full-voltage magnetic.

1.3 DEFINITIONS
   A. CPT: Control power transformer.
   B. MCCB: Molded-case circuit breaker.
   C. MCP: Motor circuit protector.
   D. N.C.: Normally closed.
   E. N.O.: Normally open.
   F. OCPD: Overcurrent protective device.
   G. SCR: Silicon-controlled rectifier.

1.4 PERFORMANCE REQUIREMENTS
   A. Seismic Performance: Enclosed controllers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
      1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 ACTION SUBMITTALS
   A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.
   B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.
      1. Show tabulations of the following:
         a. Each installed unit's type and details.
         b. Factory-installed devices.
         c. Nameplate legends.
         d. Short-circuit current rating of integrated unit.
         e. Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.
         f. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.
      2. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS
   A. Seismic Qualification Certificates: For enclosed controllers, accessories, and components, from manufacturer.
      1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
      3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
   B. Field quality-control reports.
   C. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

1.7 CLOSEOUT SUBMITTALS
   A. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:
      1. Routine maintenance requirements for enclosed controllers and installed components.
2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
3. Manufacturer's written instructions for setting field-adjustable overload relays.
4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.

1.8 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Comply with NFPA 70.
C. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Section 26 0548.16 "Seismic Controls for Electrical Systems."

1.9 DELIVERY, STORAGE, AND HANDLING
A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.10 PROJECT CONDITIONS
A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).

1.11 COORDINATION
A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Sector; Eaton Corporation.
   2. General Electric Company.
   4. Square D; by Schneider Electric.

2.2 FULL-VOLTAGE CONTROLLERS
A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.
B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.
   1. Configuration: Nonreversing.
   2. Flush or Surface mounting.
C. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
   1. Configuration: Nonreversing.
   2. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type or melting alloy type.
   3. Flush or Surface mounting.
D. Magnetic Controllers: Full voltage, across the line, electrically held.
   1. Configuration: Nonreversing.
   2. Contactor Coils: Pressure-encapsulated type.
The Church of Jesus Christ of Latter Day Saints
Garden City Assembly Hall

ENCLOSED CONTROLLERS

2.3 ENCLOSED CONTROLLERS

A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.
   1. Dry and Clean Indoor Locations: Type 1.
   2. Outdoor Locations: Type 3R.
   3. Wash-Down Areas: Type 4X.
   4. Other Wet or Damp Indoor Locations: Type 4.
   5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.
2.4 ACCESSORIES
A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
      a. Push Buttons: Shrouded types; momentary as indicated.
      b. Pilot Lights: LED types; colors as indicated; push to test.
      c. Selector Switches: Rotary type.
   2. Meters: Panel type, 2-1/2-inch (64-mm) minimum size with 90- or 120-degree scale and plus or minus two percent accuracy. Where indicated, provide selector switches with an off position.
B. Reversible N.C./N.O. auxiliary contact(s).
C. Breather and drain assemblies, to maintain interior pressure and release condensation in Type 4 Type 4X, and/or Type 7 enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
D. Cover gaskets for Type 1 enclosures.

PART 3 - EXECUTION
3.1 EXAMINATION
A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION
A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 26 0529 "Hangers and Supports for Electrical Systems."
B. Floor-Mounted Controllers: Install enclosed controllers on 4-inch (100-mm) nominal-thickness concrete base. Comply with requirements for concrete base specified in Section 03 3000 "Cast-in-Place Concrete."
   1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
   2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   4. Install anchor bolts to elevations required for proper attachment to supported equipment.
C. Seismic Bracing: Comply with requirements specified in Section 26 0548.16 "Seismic Controls for Electrical Systems."
D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
E. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.
F. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
G. Comply with NECA 1.

3.3 IDENTIFICATION
A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved nameplate.
   3. Label each enclosure-mounted control and pilot device.
3.4 CONTROL WIRING INSTALLATION
A. Install wiring between enclosed controllers and remote devices. Comply with requirements in Section 26.0523 "Control-Voltage Electrical Power Cables."
B. Bundle, train, and support wiring in enclosures.
C. Connect selector switches and other automatic-control selection devices where applicable.
   1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
   2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 ADJUSTING
A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.
C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Owner before increasing settings.

3.6 DEMONSTRATION
A. Train Owner’s maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION
SECTION 26 4113
LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL
1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes lightning protection system for ordinary structures.

1.3 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Shop Drawings:
   1. Include layouts of the lightning protection system, with details of the components to be used in the installation.
   2. Include raceway locations needed for the installation of conductors.
   3. Details of air terminals, ground rods, ground rings, conductor supports, splices, and terminations, including concealment requirements.
   4. Include roof attachment details, coordinated with roof installation.
   5. Calculations required by NFPA 780 for bonding of metal bodies.

1.4 INFORMATIONAL SUBMITTALS
A. Coordination Drawings: Lightning protection system Shop Drawings, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Lightning protection cabling attachments to roofing systems and accessories.
   2. Lightning protection strike termination device attachment to roofing systems, coordinated with the roofing system manufacturer.
   3. Lightning protection system components penetrating roofing and moisture protection systems and system components, coordinated with the roofing system manufacturer.
B. Qualification Data: For Installer.
C. Product Certificates: For each type of roof adhesive for attaching the roof-mounted air terminal assemblies, approved by the roofing-material manufacturer.
D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS
A. Maintenance Data: For lightning protection system to include in maintenance manuals.
   1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:
      a. Dimensioned site plan showing dimensioned route of the ground loop conductor and the ground rod locations. Comply with requirements of Section 01 7839 "Project Record Documents."
      b. A system testing and inspection record, listing the results of inspections and ground resistance tests, as recommended by NFPA 780, Annex D.
B. Completion Certificate:

1.6 QUALITY ASSURANCE
A. Installer Qualifications: UL-listed installer, category OWAY or LPI Master Installer.

PART 2 - PRODUCTS
2.1 MANUFACTURERS
I. Equal as approved by Architect before bidding. See Section 01 6200.

2.2 PERFORMANCE REQUIREMENTS
A. Lightning Protection Standard: Comply with NFPA 780 requirements for Class I buildings.
B. Lightning Protection Components, Devices, and Accessories: Listed and labeled by a qualified testing agency as complying with UL 96, and marked for intended location and application.

2.3 MATERIALS

A. Air Terminals:
   1. Aluminum unless otherwise indicated.
   2. 1/2-inch (12.7-mm) diameter by 12 inches (305 mm) long.
   3. Rounded tip.
   4. Threaded base support.

B. Air Terminal Bracing:
   1. Aluminum.
   2. 1/4-inch (6-mm) diameter rod.

C. Class 1 Main Conductors:
   1. Stranded Copper: 57,400 circular mils in diameter.
   2. 

D. Ground Loop Conductor: Stranded copper.

E. Ground Rods:
   1. Material: Copper-clad steel.
   2. Diameter: 3/4 inch (19 mm).
   3. Rods shall be not less than 120 inches (3050 mm) long.

F. Conductor Splices and Connectors: Compression fittings that are installed with hydraulically operated tools, or exothermic welds, approved for use with the class type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems according to NFPA 780.

B. Install conductors with direct paths from air terminals to ground connections. Avoid bends less than 90 degrees and 8 inches (203 mm) in radius and narrow loops.

C. Conceal conductors within normal view from exterior locations at grade within 200 feet (60 m) of building. Comply with requirements for concealed systems in NFPA 780.

   1. Roof penetrations required for down conductors and connections to structural-steel framework shall be made using listed through-roof fitting and connector assemblies with solid rods and appropriate roof flashings. Use materials approved by the roofing manufacturer for the purpose. Conform to the methods and materials required at roofing penetrations of the lightning protection components to ensure compatibility with the roofing specifications and warranty.

   2. Install conduit where necessary to comply with conductor concealment requirements.

   3. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's written instructions.

D. Ground Ring Electrode: The conductor shall be not less than the main-size lightning conductor.

3.2 CONNECTIONS

A. Aboveground concealed connections, and connections in earth or concrete, shall be done by exothermic welds or by high-compression fittings listed for the purpose.

B. Aboveground exposed connections shall be done using the following types of connectors, listed and labeled for the purpose: exothermic weld.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3.3 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.
3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
   1. Perform inspections as required to obtain a UL Master Label for system.
   2. Perform inspections to obtain an LPI certification.

B. Prepare test and inspection reports and certificates.

END OF SECTION
SECTION 26 5100
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
   1. Interior lighting fixtures, lamps, and ballasts.
   2. Exit signs.
   3. Lighting fixture supports.
B. Related Sections:
   1. Section 26 0923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
   2. Section 26 2726 "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.3 DEFINITIONS
A. BF: Ballast factor.
B. CCT: Correlated color temperature.
C. CRI: Color-rendering index.
D. LER: Luminaire efficacy rating.
E. Lumen: Measured output of lamp and luminaire, or both.
F. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS
A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
   1. Physical description of lighting fixture including dimensions.
   2. Emergency lighting units including battery and charger.
   3. Ballast, including BF.
   5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
   6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Wiring Diagrams: For power, signal, and control wiring.
C. Installation instructions.

1.5 INFORMATIONAL SUBMITTALS
A. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.
B. Field quality-control reports.
C. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
   1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS
A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Comply with NFPA 70.
C. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

1.9 COORDINATION
A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS
2.1 MANUFACTURERS
A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS
A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
B. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
C. LED Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE5 and NEMA LE5A as applicable
D. Metal Parts: Free of burrs and sharp corners and edges.
E. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
G. Diffusers and Globes:
   1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
      a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
      b. UV stabilized.
   2. Glass: Annealed crystal glass unless otherwise indicated.
H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
   1. Label shall include the following lamp and ballast characteristics:
      a. "USE ONLY" and include specific lamp type.
      b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
      c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
      d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
      e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
      f. CCT and CRI for all luminaires.

2.3 EMERGENCY POWER UNIT
A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast or driver. Comply with UL 924.
1. Emergency Connection: Operate one lamp(s) continuously at an output of 1300 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.

2. Nightlight Connection: Operate one fluorescent lamp continuously.

3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
   a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.


5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

6. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.4 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
   1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
   2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
      a. Battery: Sealed, maintenance-free, nickel-cadmium type.
      b. Charger: Fully automatic, solid-state type with sealed transfer relay.
      c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
      d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
      e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
      f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.5 LED LUMINAIRES

A. Solid State Drivers and LED: Comply with DOE LM 79
   1. Total Harmonic Distortion Rating: Less than 10 percent
   2. Transient Voltage protection
   3. Power factor: 0.90 or higher
   4. Temperatures: Minus 40 deg F (minus 40 deg C) and higher
   5. Heat sink to remove heat from circuits
   6. L70 compliant to 70,000 hours minimum
   7. Color Rendering Index: 80 CRI minimum
   8. Dimmable
      a. Dimming Range: 100 to 1 percent of rated lamp lumens
      b. Input watts: Can be reduced to 20 percent of normal
      c. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
2.6 LIGHTING FIXTURE SUPPORT COMPONENTS
   A. Comply with Section 26 0529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
   B. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
   C. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).
   D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
   E. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION
3.1 INSTALLATION
   A. Lighting fixtures:
      1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
      2. Install lamps in each luminaire.
   B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.
   C. Remote Mounting of Drivers and Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
   D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
      1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
      2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
      3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
      4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
   E. Connect wiring according to Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION
   A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL
   A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to backup and retransfer to normal.
   B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 STARTUP SERVICE
   A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

3.5 ADJUSTING
   A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
      1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION
SECTION 26 5600
EXTERIOR LIGHTING

PART 1 - GENERAL
1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
1. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.
B. Related Sections:
1. Section 26 5100 "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.3 DEFINITIONS
A. CCT: Correlated color temperature.
B. CRI: Color-rendering index.
C. HID: High-intensity discharge.
D. LER: Luminaire efficacy rating.
E. Luminaire: Complete lighting fixture, including ballast housing if provided.
F. Pole: Luminaire support structure, including tower used for large area illumination.
G. Standard: Same definition as "Pole" above.

1.4 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION
A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.
B. Ice Load: Load of 3 lb/ft² (145 Pa), applied as stated in AASHTO LTS-4-M Ice Load Map.
C. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.
1. Basic wind speed for calculating wind load for poles 50 feet (15 m) high or less is 110 mph (50 m/s).
   a. Wind Importance Factor: 1.0.
   c. Velocity Conversion Factors: 1.0.

1.5 ACTION SUBMITTALS
A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Luminaire materials.
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
   a. Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
   b. Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
6. Photoelectric relays.
7. Ballasts, including energy-efficiency data.
8. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
11. Anchor bolts for poles.
B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
   3. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
   4. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS
A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.
B. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.
C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS
A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Lamps: One for every 100 of each type and rating installed. Furnish at least one of each type.
   2. Glass and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
   3. Drivers: One for every 100 of each type and rating installed. Furnish at least one of each type.
   4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.9 QUALITY ASSURANCE
A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers’ laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.
C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
E. Comply with NFPA 70.

1.10 DELIVERY, STORAGE, AND HANDLING
A. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
B. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

PART 2 - PRODUCTS
2.1 MANUFACTURERS
A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES
A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
   1. LED Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE5 and NEMA LE5A as applicable
B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
C. Metal Parts: Free of burrs and sharp corners and edges.
D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
   2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
      a. Color: As selected from manufacturer's standard catalog of colors.

2.3 LED LUMINAIRES

A. Solid State Drivers and LED: Comply with DOE LM 79
   1. Total Harmonic Distortion Rating: Less than 10 percent
   2. Transient Voltage protection
   3. Power factor: 0.90 or higher
   4. Temperatures: Minus 40 deg F (minus 40 deg C) and higher
   5. Heat sink to remove heat from circuits
   6. L70 compliant to 70,000 hours minimum
   7. Color Rendering Index: 80 CRI minimum
   8. Dimmable
      a. Dimming Range: 100 to 1 percent of rated lamp lumens
      b. Input watts: Can be reduced to 20 percent of normal
      c. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

2.4 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.
   1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
   2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
B. Luminaires Attachment Provisions: Comply with luminaire manufacturers’ mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
   1. Materials: Shall not cause galvanic action at contact points.
   3. Anchor-Bolt Template: Plywood or steel.

D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws.

E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Section 03 3000 “Cast-in-Place Concrete.”

2.5 ALUMINUM POLES

A. Poles: Seamless, extruded structural tube complying with ASTM B 429/B 429M, Alloy 6063-T6 with access handhole in pole wall.

   1. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

C. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Section 26 0526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

D. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
   1. Tapered oval cross section, with straight tubular end section to accommodate luminaire.
   2. Finish: Same as luminaire.

E. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
   2. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
      a. Color: As selected by Architect from manufacturer's full range.

2.6 POLE ACCESSORIES

A. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.
   1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.2 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:
   1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
   2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).
   3. Trees: 15 feet (5 m) from tree trunk.
C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 03 3000 "Cast-in-Place Concrete."

D. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
1. Make holes 6 inches (150 mm) in diameter larger than pole diameter.
2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days, and finish in a dome above finished grade.
3. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.
4. Cure concrete a minimum of 72 hours before performing work on pole.

E. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.

F. Raise and set poles using web fabric slings (not chain or cable).

3.3 CORROSION PREVENTION
A. Steel Conduits: Comply with Section 26 0533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES
A. Install on concrete base with top above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 03 3000 "Cast-in-Place Concrete."

3.5 GROUNDING
A. Ground metal poles and support structures according to Section 26 0526 "Grounding and Bonding for Electrical Systems."
1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Section 26 0526 "Grounding and Bonding for Electrical Systems."
1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.
3. Ground metallic components of pole accessories and foundations.

3.6 FIELD QUALITY CONTROL
A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
1. Verify operation of photoelectric controls.

C. Illumination Tests:
1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):
   c. IESNA LM-52, "Photometric Measurements of Road Sign Installations."
   d. IESNA LM-64, "Photometric Measurements of Parking Areas."
   e. IESNA LM-72, "Directional Positioning of Photometric Data."

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.7 DEMONSTRATION
A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices.
SECTION 26 8313
ROOF SNOW MELT AND GUTTER DE-ICING ELECTRIC CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes electric heating cables for snow and ice melting on roofs and in gutters with the following electric heating cables:
   1. Self-regulating, parallel resistance.

1.3 RELATED SECTIONS
A. Division 7 section “Membrane Roofing”
B. Division 7 section “Manufactured Gutters and Downspouts”

1.4 SUBMITTALS
A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each type of product indicated.
   1. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.
   2. Sensors and control equipment
B. Shop Drawings: For electric heating cable. Include plans, sections, details, and attachments to other work.
C. Coordination Drawings: Roof and gutter plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Layout of cables
   2. Method of attaching hangers to building structure.
   3. Cable drops through gutters and downspouts. Indicate down only or up/down and length.
D. Field quality-control test reports.
E. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.
F. Warranty.

1.5 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION
A. Coordinate layout and installation of electric heating cables and system components with other construction.
   1. Coordinate with rain-gutter installation requirements.
   2. Coordinate with roofing installer for installation and roof penetrations specified in Division 07 Sections.

PART 2 - PRODUCTS

2.1 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Raychem; a division of Tyco Thermal Controls.
B. Comply with UL 1673.
C. Heating Element: Pair of parallel No.16 AWG, nickel-coated stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled nonheating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.
D. Electrical Insulating Jacket: Flame-retardant polyolefin.
E. Cable Cover: Polyolefin inner jacket with Tinned-copper braid, and fluoropolymer outer jacket with UV inhibitor.
F. Maximum Operating Temperature (Power On): 150 deg F (65 deg C).
G. Capacities and Characteristics:
2. Volts/Phase: As indicated on drawings.

2.2 CONTROLS
A. Precipitation and Temperature Sensor for Snow Melting and Gutter De-Icing:
   2. Precipitation and temperature sensors shall sense the surface conditions of roof and gutter and shall be programmed to energize the cable as follows:
      a. Temperature Span: 34 to 44 deg F (1 to 7 deg C).
      b. Adjustable Delay Off Span: 30 to 90 minutes.
      c. Energize Cables: Following two-minute delay if ambient temperature is below set point and precipitation is detected.
   3. Corrosion-proof and waterproof enclosure suitable for outdoor mounting, for controls and precipitation and temperature sensors.
   4. Precipitation sensor shall be mounted in gutter.

2.3 ACCESSORIES
A. Cable Installation Accessories: Roof clips, downspout hangars, cable spacers, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.
B. Connection Kits:
   1. NEMA 4X.
   2. UV Resistive
C. Contactors
   1. Description: Electrically operated and mechanically held, combination-type contactors with nonfused disconnect, complying with NEMA ICS 2 and UL 508.
      a. Current Rating for Switching: Listing or rating consistent with type of load served.
      b. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
      c. Enclosure: Comply with NEMA 250.
      d. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

PART 3 - EXECUTION
3.1 EXAMINATION
A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Ensure surfaces in contact with electric heating cables are free of burrs and sharp protrusions.
   2. Ensure surfaces and substrates are level and plumb.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS
A. Install the following types of electric heating cable for the applications described:
   1. Snow and Ice Melting on Roofs and in Gutters: Self-regulating, parallel-resistance heating cable.

3.3 INSTALLATION
A. Install electric heating cable on roofs and in gutters and downspouts according to manufacturer's written recommendations using slack cable to allow movement without damage to cable.
B. Install cable spacers according to manufacturer's written recommendations to prevent cable overheating.
C. Electric Heating Cable Installation for Floor Radiant Heating: Install heating cable with heat-conductive fill materials such as concrete, to ensure direct contact with finished radiant surfaces.
D. Protect installed heating cables, including nonheating leads, from damage.
3.4 CONTACTOR INSTALLATION
A. Mount contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.5 CONNECTIONS
A. Ground equipment according to National Electrical Code.
B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.6 FIELD QUALITY CONTROL
A. Testing: Perform heating cable tests.
   1. Test cables for electrical continuity and insulation integrity before energizing.
   2. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
   3. Test controllers for temperature and sensor readings.
B. Repeat tests for continuity, insulation resistance, and input power after applying finished surface on heating cables.
C. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION
DIVISION 27 – COMMUNICATIONS

270526  Grounding and Bonding for Communications Systems
270528  Pathways For Communications Systems
27 1116  Communications Cabinets, Racks, Frames, and Enclosures
27 1501  Communications Horizontal Cabling
27 4117  Video Systems
27 5117  Audio Systems

END OF TABLE OF CONTENTS
SECTION 27 0526
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
1. Grounding conductors.
2. Grounding connectors.
3. Grounding busbars.

1.3 DEFINITIONS
A. BCT: Bonding conductor for telecommunications.
B. EMT: Electrical metallic tubing.
C. TGB: Telecommunications grounding busbar.
D. TMGB: Telecommunications main grounding busbar.

1.4 INFORMATIONAL SUBMITTALS
A. As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including the following:
1. Ground rods.
2. Ground and roof rings.
3. BCT, TMGB, TGBs, and routing of their bonding conductors.

1.5 QUALITY ASSURANCE
A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
1. Installation Supervision: Installation shall be under the direct supervision of ITS Technician, who shall be present at all times when Work of this Section is performed at Project site.

PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS
A. Comply with J-STD-607-A.

2.2 CONDUCTORS
A. Comply with UL 486A-486B.
B. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.
1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
2. Cable Tray Equipment Grounding Wire: No. 6 AWG.
C. Cable Tray Grounding Jumper:
1. Not smaller than No. 6 AWG 26 kcmils (13.3 sq. mm) and not longer than 12 inches (300 mm). If jumper is a wire, it shall have a crimped grounding lug with two holes and long barrel for two crimps. If jumper is a flexible braid, it shall have a one-hole ferrule. Attach with grounding screw or connector provided by cable tray manufacturer.
D. Bare Copper Conductors:
4. Bonding Cable: 14.2 sq. mm (28 kcmils), 14 strands of No. 17 AWG conductor, and 6.3 mm (1/4 inch) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 41 mm (1-5/8 inches) wide and 1.6 mm (1/16 inch) thick.

2.3 CONNECTORS
A. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.
B. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.
1. Electroplated tinned copper, C and H shaped.

C. Signal Reference Grid Connectors: Combination of compression wire connectors, access floor grounding clamps, bronze U-bolt grounding clamps, and copper split-bolt connectors, designed for the purpose.

2.4 GROUNDING BUSBARS

A. TGB: Predrilled rectangular bars of hard-drawn solid copper, 6.3 by 50 mm (1/4 by 2 inches) in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with J-STD-607-A.
   1. Predrilling shall be with holes for use with lugs specified in this Section.
   2. Mounting Hardware: Stand-off brackets that provide at least a 50-mm (2-inch) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
   3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.

B. Inspect the test results of the ac grounding system measured at the point of BCT connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of the BCT only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.

B. Comply with NECA 1.

C. Comply with J-STD-607-A.

3.3 APPLICATION

A. Conductors: Install solid conductor for No. 8 AWG and smaller and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
   1. The bonding conductors between the TGB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.
   2. The bonding conductors between the TMGB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.

B. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors except at ground rods and as otherwise indicated.
   3. Connections to Ground Rods: Bolted connectors.

C. Conductor Support:
   1. Secure grounding and bonding conductors at intervals of not less than 900 mm (36 inches).

D. Grounding and Bonding Conductors:
   1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
   2. Install without splices.
   3. Support at not more than 900-mm (36-inch) intervals.
4. Install grounding and bonding conductors in 21-mm (3/4-inch) PVC conduit until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.
   a. If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing that complies with requirements in Section 27 0528 "Pathways for Communications Systems," and bond both ends of the conduit to a TGB.

3.4 GROUNDING ELECTRODE SYSTEM
   A. The BCT between the TMGB and the ac service equipment ground shall not be smaller than No. 4 AWG.

3.5 GROUNDING BUSBARS
   A. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 50 mm (2 inches) minimum from wall, 300 mm (12 inches) above finished floor unless otherwise indicated.

3.6 CONNECTIONS
   A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than No. 6 AWG.
   B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
   C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:
      1. Use crimping tool and the die specific to the connector.
      2. Pretwist the conductor.
      3. Apply an antioxidant compound to all bolted and compression connections.
   D. Primary Protector: Bond to the TMGB with insulated bonding conductor.
   E. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Bond the equipment grounding busbar to the TGB No. 2 AWG bonding conductors.
   F. Structural Steel: Where the structural steel of a steel frame building is readily accessible within the room or space, bond each TGB and TMGB to the vertical steel of the building frame.
   G. Electrical Power Panelboards: Where an electrical panelboard for telecommunications equipment is located in the same room or space, bond each TGB to the ground bar of the panelboard.

3.7 FIELD QUALITY CONTROL
   A. Perform tests and inspections.
   B. Tests and Inspections:
      1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
   C. Excessive Ground Resistance: If resistance to ground at the BCT exceeds 5 ohms, notify Architect promptly and include recommendations to reduce ground resistance.
   D. Grounding system will be considered defective if it does not pass tests and inspections.
   E. Prepare test and inspection reports.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
   1. Metal conduits and fittings.
   2. Boxes, enclosures, and cabinets.
B. Related Requirements:
   1. Section 26 0533 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.
   2. Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling" for sealing of penetrations of communications pathways through building elements.

1.3 DEFINITIONS
A. ARC: Aluminum rigid conduit.
B. GRC: Galvanized rigid steel conduit.
C. IMC: Intermediate metal conduit.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS
A. General Requirements for Metal Conduits and Fittings:
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Comply with TIA-569-B.
B. GRC: Comply with ANSI C80.1 and UL 6.
C. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
   1. Comply with NEMA RN 1.
   2. Coating Thickness: 0.040 inch (1 mm), minimum.
D. EMT: Comply with ANSI C80.3 and UL 797.
E. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
   1. Fittings for EMT:
      a. Material: Steel or die cast.
      b. Type: Setscrew or compression.
   2. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
   3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

2.2 NONMETALLIC CONDUITS AND FITTINGS
A. General Requirements for Nonmetallic Conduits and Fittings:
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Comply with TIA-569-B.
B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
C. Rigid HDPE: Comply with UL 651A.
D. Continuous HDPE: Comply with UL 651B.
E. RTRC: Comply with UL 1684A and NEMA TC 14.
F. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.3 BOXES, ENCLOSURES, AND CABINETS
A. General Requirements for Boxes, Enclosures, and Cabinets:
   1. Comply with TIA-569-B.
   2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.
B. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.
D. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
E. Metal Floor Boxes:
   1. Material: Cast metal or sheet metal.
   2. Type: Fully adjustable.
   3. Shape: Rectangular.
   4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
F. Small Sheet Metal Pull and Junction Boxes: NEMA OS.
G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or galvanized, cast iron with gasketed cover.
H. Device Box Dimensions: 5 inches square by 2-7/8 inches deep.
I. Gangable boxes are prohibited.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION
A. Outdoors: Apply pathway products as specified below unless otherwise indicated:
   1. Aboveground Conduit: GRC.
   2. Underground Conduit: RNC, Type EPC-40-PVC.
   3. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
B. Indoors: Apply pathway products as specified below unless otherwise indicated:
   1. Exposed, Not Subject to Physical Damage: EMT.
   2. Exposed and Subject to Physical Damage: GRC. Pathway locations include the following:
      a. Loading dock.
      b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
      c. Mechanical rooms.
      d. Vehicle Garages
   3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
   4. Damp or Wet Locations: GRC.
   5. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical-fiber-cable pathway.
   6. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: EMT.
   7. Boxes and Enclosures: NEMA 250 Type 1, except use NEMA 250 Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
C. Minimum Pathway Size: 1 inch (27 mm).
D. Pathway Fittings: Compatible with pathways and suitable for use and location.
   1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
   2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
   3. EMT: Use setscrew or compression, steel cast-metal fittings. Comply with NEMA FB 2.10.

3.2 INSTALLATION
A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
B. Keep pathways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
C. Complete pathway installation before starting conductor installation.
D. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for hangers and supports.
E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
F. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches (300 mm) of changes in direction. Utilize long radius ells for all optical-fiber cables.
G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
H. Support conduit within 12 inches (300 mm) of enclosures to which attached.
I. Pathways Embedded in Slabs:
   1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot (3-m) intervals.
   2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
   3. Arrange pathways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
   4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
   5. Change from RNC, Type EPC-40-PVC to GRC before rising above floor.
J. Stub-ups to Above Recessed Ceilings:
   1. Use EMT, IMC, or RMC for pathways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
L. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
N. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
P. Cut conduit perpendicular to the length. For conduits of 2-inch (53-mm) trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
Q. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.
R. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
   1. 1-Inch (27-mm) Trade Size and Larger: Install pathways in maximum lengths of 75 feet (23 m).
   2. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
S. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.
T. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service pathway enters a building or structure.
3. Where otherwise required by NFPA 70.
U. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.
V. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.
W. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
X. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
Y. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
Z. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
AA. Set metal floor boxes level and flush with finished floor surface.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS
A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 27 0544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.4 FIRESTOPPING
A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.5 PROTECTION
A. Protect coatings, finishes, and cabinets from damage or deterioration.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION
SECTION 27 1116
COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL
1.1 SUMMARY
A. Selection Includes But Is Not Limited To:
   1. Furnish and install communications cabinets, racks, frames, and enclosures as described in Contract Documents.
B. Related Requirements:
   1. Section 26 0526: ‘Grounding And Bonding For Electrical Systems’.
   2. Section 27 1501: ‘Communications Horizontal Cabling’.
C. Products Installed But Not Furnished Under This Section:
   1. Cable Management, Vertical Cable Management, and Horizontal Cable Management.

1.2 REFERENCES
A. Association Publications:
   1. British Standards Institution (BSI):
   3. Institute of Electrical and Electronics Engineers:
   4. Telecommunications Industry Association:
B. Reference Standards:
   1. International Electrotechnical Commission:
   2. International Organization for Standardization / International Electrotechnical Commission:
   3. National Fire Protection Association:
   4. Telecommunications Industry Association:
      b. TIA-569, ‘Telecommunications Pathways And Spaces’ (Revision D, 2015).
      g. TIA-1152, ‘Requirements for Field Test Instruments and Measurements forBalanced Twisted-Pair Cabling’ (Revision A 2016).

1.3 SUBMITTALS
A. Action Submittals:
   1. Product Data:
      a. Provide Manufacturer’s documentation and descriptive information on each piece of equipment to be used.

PART 2 - PRODUCTS
2.1 SYSTEMS
A. Manufacturers:
   1. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
   
   218036 / Garden City Assembly Hall 17 1116 - 1 Communications Cabinets, Racks, Frames, And Enclosures
PART 3 - EXECUTION

3.1 INSTALLERS
A. Approved Installers:
   1. Approved installers in Section 27 5117 are to both furnish and install components of this section. See Section 01 4301. Installer requirements of Section 01 4301 applies.

3.2 INSTALLATION
A. Equipment Cabinet:
   1. See Section 27 5117 ‘Sound System’ for installation of Sound Equipment.

B. Equipment Cabinet:
   1. Install vent panels at top and bottom of equipment cabinets and between components where possible for maximum ventilation when equipment locations is not specified in Contract Drawings. Locate amplifiers at top of cabinet. Locate equalizers below amplifiers, separated by several vent panels.
   2. Securely fasten equipment plumb and square in place. Utilize all fastening holes in front of cabinet.
   3. Securely fasten in place equipment that is not rack mounted, including relays and other small components. Do not use sticky-back tape.
   4. Install balancing / isolation transformer when balanced and unbalanced components are connected.
   5. Wire XLR-type connections with pin 2 hot, pin 1 shield.
   6. Connect powered components to 120 VAC outlets on voltage suppressor power bars. Do not connect to outlets on other components.
   7. Identification:
      a. Legibly identify user-operated system controls and system input / output jacks using engraved, permanently attached laminated plastic plates or imprinted Lexan labels. Label equipment and controls within equipment cabinets using similar labels or printed labels from a label maker or laser printer.
      b. Affix label to rack panel inside cabinet listing name and telephone number of installer. Appropriate warranty instructions may be included.

C. Communications Racks, Frames and Enclosures:
   1. Racks shall be installed as per Manufacturer’s recommendations.
   2. Racks shall be securely attached to concrete floor with 3/8 inch (9.5 mm) minimum hardware or as required by local codes.
   3. Place racks with 36 inches (900 mm) minimum clearance front and back from walls and 28 inches (710 mm) clear on one side of rack. When mounted in row, maintain 36 inches (900 mm) minimum from wall behind and in front of row of racks and from wall at each end of row.
   4. Grounding:
      a. Racks shall be grounded to telecommunications ground bus bar as per Section 260526 ‘Grounding And Bonding For Electrical Systems’.
      b. Racks shall be grounded in accordance with TIA-607.
   5. Seismic Bracing:
      a. Comply with IBC and local seismic requirements for all equipment and conduit pathways.
   6. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with rack upon completion of installation.
   7. Mounted termination block fields shall be mounted on Terminal Board in Technology Room provided by Electrical as shown in Contract Documents.
      a. Wall mounted termination block fields shall be installed with lowest edge of Terminal Board.

3.3 FIELD QUALITY CONTROL
A. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
   1. Correct any work found defective or not complying with Contract Document requirements at no additional cost to Owner.

END OF SECTION
SECTION 27 1501
COMMUNICATIONS HORIZONTAL CABLEING

PART 1 - GENERAL

1.1 SUMMARY
A. Includes But Not Limited To:
   1. Furnish, install, and test communications horizontal cabling as described in Contract Documents including following:
      a. Cables and related terminations.
      b. Patch cords and modular connectors.
      c. Surface raceway and outlet poles.
      d. Support and grounding hardware.
      e. UTP Cable.
      f. UTP Patch cords.
      g. UTP Connector Modules.
      h. Installation and testing of Owner Furnished Network Equipment.
B. Related Requirements:
   1. Division 26: Raceways and surface boxes.
   2. Section 07 8400: 'Firestopping' for furnishing and installation of firestopping.
   3. Section 26 0526: 'Grounding And Bonding For Electrical Systems' for installation and termination.
   4. Section 27 1116: 'Communications Cabinet, Racks, Frames, and Enclosures'.
   5. Section 27 4117: 'Video And Satellite Distribution Systems'.
   6. Section 27 5117: 'Audio Systems'.
C. Products Installed But Not Furnished Under This Section:
   1. Owner Furnished Network Equipment as specified on TT (Technology Telecommunication) and TA (Technology Audiovisual) Drawings as shown in Contract Documents including:
      a. Internet Firewall.
      b. ISP Modem.
      c. Network Switch.
      d. Wireless Access Port.
D. Related Requirements:
   1. Section 01 6400: Owner will provide Network Equipment as specified on TT (Technology Telecommunication) and TA (Technology Audiovisual) Drawings as shown in Contract Documents. Contract Documents establishes quality of materials and installation for information of Contractor, Architect, and Owner's Representatives. Design Criteria in PART 2 of this Section identifies Contractor's responsibility for Owner Network Equipment.

1.2 REFERENCES
A. Association Publications:
   1. British Standards Institution (BSI):
   3. Institute of Electrical and Electronics Engineers:
      a. IEEE 802.3-2018, 'Standard for Ethernet'.

The Church of Jesus Christ of Latter-day Saints  
Garden City Assembly Hall  


4. Telecommunications Industry Association:  

B. Reference Standards:  
   1. International Electrotechnical Commission:  
   2. International Organization for Standardization / International Electrotechnical Commission:  
   3. National Fire Protection Association:  
      b. installations.  
   4. Telecommunications Industry Association:  
      b. TIA-569, ‘Telecommunications Pathways And Spaces’ (Revision D, 2015).  
      g. TIA-1152, ‘Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling’ (Revision A 2016).  
   5. Underwriters Laboratories:  
         1) 94HB, ‘Horizontal Burn Test’.  

1.3 ADMINISTRATIVE REQUIREMENTS  
A. Coordination:  
1. Coordinate with Project Manager and/or Facility Manager well in advance of Substantial Completion for installation of all Owner Furnished Network Equipment.

1.4 SUBMITTALS  
A. Action Submittals:  
1. Product Data:  
   a. Provide Manufacturer’s documentation, installation instructions, and descriptive information on each piece of equipment to be used.  
2. Shop Drawings:  
   a. Provide three (3) copies of labeling system reflecting approved label scheme for cable installation for racks, cables, panels, and outlets.

B. Informational Submittals:  
1. Certificates:  
   a. Provide Installer certificates of qualifications required.  
2. Design Data:  
   a. Identification and labeling:  
      1) Provide labeling system for cable installation to be approved by Owner.  
         a) Clearly identify all components of system: racks, cables, panels and outlets.
Designate cables origin and destination and unique identifier for cable within facility by room number and port count.

Racks and patch panels shall be labeled to identify location within cable system infrastructure.

After system installation, provide three (3) full documentation sets to Consulting Engineer/Architect for approval.

b. After system installation, provide three (3) full documentation sets to Consulting Engineer/Architect for approval.

3. Tests And Evaluation Reports:
   a. Submit documentation within ten (10) working days of completion of each testing phase. This is inclusive of all test results and record drawings.
   b. Draft drawings may include annotations done by hand. Final copies of all drawings shall be submitted within thirty (30) working days of completion of each testing phase.
   c. At request of Consulting Engineer, provide copies of original test results.

4. Field Quality Control Submittals:
   a. Architect will provide floor plans in paper and electronic formats on which record documentation information can be recorded.

5. Qualification Statements:
   a. Letter from Manufacturer certifying level of training and experience of Installer.

C. Closeout Submittals:
   1. Include following information in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Provide operating and maintenance instructions for each item of equipment submitted under Product Data.
      b. Warranty Documentation:
         1) Final, executed copy of Warranty.
      c. Record Documentation:
         1) Manufacturers documentation:
            a) Manufacturer’s literature or cut sheet.
         2) Tests and evaluation reports.
         3) As-built Documentation:
            a) Provide record document to include cable routes and outlet locations.
               (1) Sequential number shall identify outlet locations.
               (2) Numbering, icons, and drawing conventions used shall be consistent throughout all documentation.
               (3) Provide labeling system information.

1.5 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. System shall meet approval of authority having jurisdiction (AHJ). NEC and State and/or local ordinances and regulations shall govern unless more stringent requirements are specified.
   2. Meet all TIA/EIA commercial building wiring standards.
   4. All Networks shall be installed per applicable standards and manufacturer's guidelines.
   5. Cable assemblies shall be UL / CE Listed and CSA Certified. Cables shall be a distinctive green or green/yellow in color, and all jackets shall be UL, VW-1 flame rated.
   6. Grounding shall conform to all required Commercial Building Grounding and Bonding Requirements for Telecommunications, Electrical Codes, and Manufacturer's grounding requirements.

B. Qualifications: Requirements of Section 01 4301 applies, but is not limited to following:
   1. Manufacturer Qualifications:
      a. Provide single source for all products of system:
         1) KeyConnect by Belden.
         2) Netkey by Panduit.
         3) System 6 by Siemon.
4) Uniprise Media 6 by CommScope.

2. Installers Qualifications:
   a. Approved and Certified by Manufacturer (installation and maintenance trained):
      1) Belden Certified System Vendor (CSV).
         a) Belden Certified LDS Partner.
      2) CommScope Certified Business Partner.
         a) CommScope Certified LDS Partner.
      3) Panduit Certified Installer (PCI).
      4) Siemon Certified Installers (CI).
   b. Three (3) year experience with similar projects. Provide documentation.

1.6 WARRANTY

A. Special Warranty:
   1. Cabling System:
      a. Provide warranty for permanent link cabling system to meet Category 6 standard requirements for structured cabling system for twenty (20) years.
   2. Installer Warranty:
      a. Installer guarantees that all work is in accordance with all express and implied requirements of Contract Documents, that all work is of good quality, and further warrants work and material for period of (1) year from date of substantial completion of project, unless longer period of time is specified in Contract. All work not conforming to these requirements, may be considered defective:
         1) If, within one (1) year after substantial completion of work, or within such longer period of time as may be prescribed by law or by terms of any warranty in Contract, any of work is found to be defective or not in accordance with Contract, Installer shall at Installer cost correct it promptly after receipt of written notice from Owner.
         2) Installer's obligation shall survive termination of Contract.
         3) Owner shall give such notice within reasonable time after discovery of condition.
   b. Installer warrants to Owner that all materials and equipment furnished under this Contract shall be new unless otherwise specified, free from faults and defects and in conformance with Contract Documents:
      1) Contractor shall secure manufacturer's warranties and deliver copies thereof to Owner upon completion of work.
      2) All such warranties shall commence from date of substantial completion, and will not in any way reduce Installer's responsibilities under his Contract.
      3) Whenever guarantees or warranties are required by specifications for longer period than one year, such longer period shall govern.
   c. Installer will provide twenty (20) year minimum end to end manufacturer warranty.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED PRODUCTS

A. Category Four Products. See Section 01 6200 for definitions of Categories:
   1. LDS Network Equipment as specified on TT (Technology Telecommunication) and TA (Technology Audiovisual) Drawings as shown in Contract Documents including:
      a. Internet Firewall.
      b. ISP Modem.
      c. Network Switch.
      d. Wireless Access Port.
   2. Coordination:
      a. Coordinate installation of all Owner Furnished Network Equipment including but limited to:
         1) Installation and configure devices in accordance with LDS requirements.
         2) Proper set-up of network equipment.
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

3) Owner Furnished internet service to building prior to final installation of AV and Voice Data Equipment.
4) Testing of network equipment.

2.2 SYSTEMS

A. Manufacturers:
   1. Category Four Approved Manufacturers and Products. See Section 01 6200 for definitions of Categories:

B. Design Criteria:
   1. Must install single manufacture as complete permanent link.
      a. Category 6 minimum compliance margin on all parameters beyond category 6 and Power Sum ACR out to 250 MHz.
   2. Entire Category 6 system to be provided by single approved Manufacturer throughout.
   3. Install structured cabling system that will be able to support interconnections to active telecommunications equipment for voice and data applications in multi vendor, multi product environment. Structured cabling system should adhere to TIA-568, TIA-606; TIA-607, and TIA-942 standards with respect to pathways, distribution, administration, and grounding of the system.
   4. Each room drop will consist of two drops each consisting of two terminations can be interoperable to accommodate either voice or data applications. Provide convenience phone drops that will consist of single termination that will be installed in proper faceplate for each location’s phone.
   5. Install, terminate, test, and guarantee each drop according to customer all applicable standards and customer preferences.
   6. Horizontal cables will be rated Category 6 (250 MHz) in performance and rated to comply with TIA-568 to connector outlets at Work Area. Horizontal cables will home run back to Technology Room (Entrance Facility / Main Cross Connect) and will terminate on individual Category 6 rated jacks to populate modular 48 port angled patch panel on open or flat patch panel inside enclosures. All cables will be patched at cutover as interconnection into floor serving active equipment using RJ45 modular equipment cables rated to Category 6.
   7. Match additions to horizontal raceway to complete system according to TIA-568 where suspension and protection gaps exist.

C. Components – Work Area Subsystem:
   1. Provide connectivity equipment used to connect horizontal cabling subsystem and equipment in work area. Both copper and fiber media shall be supported. Connectivity equipment shall include following options:
      a. Patch (equipment) cords and modular connectors.
      b. Outlets and surface mount boxes.
      c. Surface raceway and outlet poles.
      d. Consolidation point / MUIO.
   2. Patch Cords and Modular Connectors:
      a. Match horizontal cabling medium and rating. Same Manufacturer shall provide modular connectors and patch cords. Total patch cord length at work area is not to exceed 10 feet (3.0 m).
      b. Copper Connectivity:
         1) Network Cabling System:
            a) Provide for Work Area subsystem, including all modular connectors.
            b) Modular connectors shall support of high-speed networks and applications designed for implementation on copper cabling.
            c) Outlets shall utilize fully interchangeable and individual connector modules that mount side-by-side to facilitate quick and easy moves, adds and changes.
         2) Modular Connections:
            a) Data Modules shall be Category 6:
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

(1) Eight position modules required in all work areas and shall exceed connector requirements of TIA Category 6 standard.
(2) Prove termination cap with strain relief on cable jacket, ensure cable twists are maintained to within 1/8 inch (3 mm) and include wiring scheme label. Wiring scheme label shall be available with TIA-568 wiring schemes.

b) Terminations shall use for TIA-568 wiring scheme.
c) Modules shall terminate 4 pair 23 100-ohm solid unshielded twisted pair cable.
d) Modules shall meet ISO 11801 standard including complying with intermateability standard IEC 60603-7 for backward compatibility.
e) Category 6 modules shall have UL and CSA approval.
f) Modules shall have ETL verified Category 6 performance and ISO 11801 Class E performance in both basic and channel links.
g) Modules shall be universal in design, accepting 2, 3, or 4 pair modular plugs without damage to outer jack contacts.
h) Modules shall be able to be re-terminated minimum of 10 times and be available in 11 standard colors for color-coding purposes.
i) Jack shall snap into all outlets and patch panels.
j) Module shall include black base to signify Category 6 400 MHz performance.

3) Patch Cords:
a) Category 6 patch cords 'shall be factory terminated with modular plugs featuring one-piece, tangle-free latch design and strain-relief boots to support easy moves, adds, and changes.
b) Constructed with Category 6 23-AWG stranded UTP cable.
c) Each patch cord shall be one hundred (100) percent performance tested at factory in channel test to TIA Category 6 standard.
d) Patch cords shall come in standard lengths of 3, 5, 7, 9, 14 and 20 feet (0.90, 1.50, 2.15, 2.75, 4.20 and 6.1 meters) and 6 standard colors of Blue or White.
e) Provide one (1) each 8 feet (2.45 m) patch cord for 50 percent of terminated work station ports.

3. Outlets and Surface Mount Boxes:
a. Outlets and surface mount boxes shall support network system by providing high-density in-wall, surface mount cabling applications.
b. Provide faceplates for flush mount:
   1) Outlets faceplates shall be manufactured from high-impact thermoplastic material with UL 94 flammability rating of 94 HB or better.

4. Copper Cable:
a. Design Criteria:
   1) Performance exceeds all TIA-568 Category 6 and ISO 11801 for Class E cable requirements.
   2) ETL tested and verified for Category 6 component performance.
   3) Conductors are twisted in pairs with four pairs contained in flame retardant PVC jacket separated by a spline.
   4) Performance tested to 650 MHz.
   5) Plenum (CMP) and non-plenum/riser (CMR) flame rated.
   6) Maximum installation tension of 25 lbs (110 N).
   7) Installation temperature range: 32 deg F (0 deg C) to 140 deg F (60 deg C).
   8) Operating temperature range: 14 deg F (minus 10 deg C) to 140 deg F (60 deg C).
   9) Cable diameter: Riser – 0.26 inch (6.604 mm) 0.260”; Plenum – 0.25 inch (6.35 mm).
   10) Easy payout, reel-in-a-box and descending length markings on cable speed installation.
   11) Supports following applications: Ethernet 10BASE-T, 100BASE-T (Fast Ethernet) and 100BASE-T (Gigabit Ethernet); 1.2Gb/s ATM; Token Ring 4/16; digital video; and broadband/baseband analog video.
   12) Color shall be blue.

D. Horizontal Distribution Cabling:
1. General:
a. Horizontal distribution cabling system is portion of telecommunications cabling system that extends from work area telecommunications outlet/connector to horizontal cross-connect in Technology Room (Entrance Facility / Main Cross Connect).
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

1) Horizontal cabling in office should terminate in Technology Room (Entrance Facility / Main Cross Connect) located on same floor as Work Area being served.
2) Horizontal cabling is installed in star topology (home run).
3) Bridged taps and splices are not permitted as part of copper horizontal cabling.

E. Components – Technology Room (Entrance Facility / Main Cross Connect):

1. General:
   a. Connect networking equipment to horizontal and backbone cabling subsystems:
      1) Termination hardware (connectors and patch cords), racks, cable management products and cable routing products.
      2) Cable termination hardware.
   b. Terminate each horizontal or backbone cabling run using appropriate connectors or connecting blocks depending upon cable type:
      1) Matching patch cords will be used to perform cross-connect activities or to connect into the networking/voice hardware:
         a) Category 6 Enhanced Unshielded Twisted Pair (UTP).
   c. Four-pair Category 6 UTP cabling shall be terminated onto four-pair Category 6 module:
      1) All modules shall be terminated using 568-B wiring scheme.
      2) Eight position module shall exceed connector requirements of TIA Category 6 standard.
      3) Jack termination to 4-pair, 100 ohm solid unshielded twisted pair cable shall be by use of forward motion termination cap and shall not require use of punchdown or insertion tool.

2. Rack, Cabinet, and Cabling Management Enclosure:
   a. Cable Management:
      1) Cable Management System shall be used to provide neat and efficient means for routing and protecting fiber and copper cables and patch cords on telecommunication racks and enclosures.
      2) Provide complete cable management system comprised of vertical and horizontal cable managers to manage cables on both front and rear of rack.
      3) System shall protect network investment by maintaining system performance, controlling cable bend radius and providing cable strain relief.
   b. Vertical Cable Management:
      1) General:
         a) Vertical cable managers include components that aid in routing, managing and organizing cable to and from equipment.
         b) Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief.
      2) Provide panels with universal design mounting to 19 inches (480 mm) rack and constructed of steel bases with PVC duct attached.
      3) Covers shall be able to hinge from either side yet still be easily removed to allow for quick moves, adds, and changes.
   c. Horizontal Cable Management:
      1) General:
         a) Horizontal cable managers include components that aid in routing, managing and organizing cable to and from equipment.
         b) Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief.
      2) Provide panels with universal design mounting to 19 inches (480 mm) rack and constructed of steel bases with PVC duct attached.
      3) Duct fingers shall include retaining tabs to retain cables in place during cover removal.
      4) Covers shall be able to hinge from either side yet still be easily removed to allow for quick moves, adds, and changes.

3. Patch Cords:
   a. Provide patch cords between modular patch panels configured as cross-connect or between patch panel and networking hardware when patch is used as interconnect. Provide one (1) each 3 feet (0.90 m) patch cord for each terminated patch panel port.
   b. Provide patch cords as indicated on Drawings and Specifications as shown in Contract Documents. Ensure all devices are fully connected to network equipment.
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

- Provide additional patch cords with appropriate length to connect all Owner provided internet enabled appliances (IEA) as specified on TT (Technology Telecommunication) and TA (Technology Audiovisual) Drawings as shown in Contract Documents.
- Patch cords shall be factory terminated with modular plugs featuring one-piece, tangle-free latch design and black strain-relief boots to support easy moves, adds and changes.
- Construct patch cords with Category 6 24-AWG stranded UTP cable.
- Patch cords shall be one hundred (100) percent performance tested at factory inchannel test to Category 6 standard.

4. Patch Panels:
   a. Four-pair Category 6 UTP cabling shall be terminated onto four-pair-punch-down style connecting hardware mounted to rear of integral patch panels and routed to Category 6 modules on front face of patch panel.
   b. Patch panels shall be universal for TIA-568 wiring configurations.
   c. Patch panels shall have removable 6-port design that allows 6-port module to be removed without disrupting other ports.
   d. Integral cable tie mounts shall be included in panel for cable management on back of panel.
   e. Port and panels shall be easy to identify with write-on areas and optional label holder for color-coded labels.
   f. Rack mountable patch panels shall mount to standard 19 inches (480 mm) rack.

5. Grounding and Bonding:
   a. Provide Telecommunications Bonding Backbone:
      1) Ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has potential to act as current carrying conductor.
      2) Install telecommunication Bonding Backbone independent of building’s electrical and building ground.
      3) Designed in accordance with recommendations contained in TIA-607 Telecommunications Bonding and Grounding Standard.
   b. All wires used for telecommunications grounding purposes shall be identified with green insulation:
      1) Non-insulated wires shall be identified at each termination point with wrap of green tape.
      2) All cables and bus bars shall be identified and labeled as required.

6. Firestopping: Furnish and install firestopping as per Section 07 8400.

PART 3 - EXECUTION
3.1 INSTALLATION
A. General:
   1. Install communications system in accordance with Manufacturer’s written instructions, and complying with applicable portions of NEC ‘Standard of Installation’.
B. Work Area Outlets:
   1. Cables shall be coiled in in-wall or surface-mount boxes if adequate space is present to house cable coil without exceeding Manufacturers bend radius.
      a. No more than 12 inches (300 mm) of UTP slack shall be stored in in-wall box, modular furniture raceway, or insulated walls.
      b. Excess slack shall be loosely configured and stored in ceiling above each drop location when there is not enough space present in outlet box to store slack cable.
   2. Cables shall be dressed and terminated in accordance with TIA-568, Manufacturer’s recommendations, and best industry practices.
   3. Cables shall be bundled using Velcro straps at least 0.25 inch (6.35 mm) wide. Use of plastic wire ties or zip ties is not allowed on project.
   4. Pair untwist at termination shall not exceed 0.125 inch (3.175 mm).
   5. Bend radius of cable in termination area shall not be less than 4 times outside diameter of cable.
   6. Cable jacket shall be maintained to within one inch (25 mm) of termination point.
7. Data / voice jacks, unless otherwise noted in Contract Documents, shall be located on each faceplate.
8. Horizontal Cabling:
   a. Data jacks in horizontally oriented faceplates shall occupy rightmost position(s).
   b. Voice jacks shall occupy the top position(s) on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the left-most position(s).
C. Horizontal Cross Connect:
1. Cables shall be dressed and terminated in accordance with TIA-568, Manufacturer’s recommendations, and best industry practices.
2. Pair untwist at termination shall not exceed 0.125 inch (3.175 mm).
   a. Bend radius of cable in termination area shall not be less than 4 times outside diameter of cable.
3. Cables shall be neatly bundled and dressed to their respective panels or blocks.
   a. Each panel or block shall be fed by individual bundle separated and dressed back to point of cable entrance into rack or frame.
   b. Cables shall be bundled using Velcro straps at least 0.25 inch (6.35 mm) wide. Use of plastic wire ties or zip ties is not allowed on project.
4. Cable jacket shall be maintained as close as possible to termination point.
5. Each cable shall be clearly labeled on cable jacket behind patch panel at location that can be viewed without removing bundle support ties.
   a. Cables labeled within bundle, where label is obscured from view shall not be acceptable.
6. Horizontal Cabling:
   a. A pull cord (nylon; 1/8 inch (3 mm) minimum) shall be co-installed with all cable installed in any conduit.
   b. Cable raceways shall not be filled greater than required by TIA-569 maximum fill for particular raceway type.
   c. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.
   d. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in enclosure intended and suitable for purpose.
   e. Cable’s minimum bend radius and maximum pulling tension shall not be exceeded.
   f. If J-hook or trapeze system is used to support cable bundles, all horizontal cables shall be supported at 48 inch (1 200 mm) to 60 inches (1 500 mm) maximum intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
   g. Horizontal distribution cables shall be bundled in groups of no more than 25 cables. Cable bundle quantities in excess of 25 cables may cause deformation of bottom cables within bundle and degrade cable performance.
   h. Cables shall be bundled using Velcro straps at least 0.25 inch (6.35 mm) wide. Use of plastic wire ties or zip ties is not allowed on project.
   i. Cable shall be installed above fire-sprinkler systems and shall not be attached to system or any ancillary equipment or hardware. Cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
   j. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, install appropriate carriers to support cabling.
   k. Cables shall be identified by self-adhesive label and meet requirements of TIA-606. Cable label shall be applied to cable behind faceplate on section of cable that can be accessed by removing cover plate.
   l. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in run and at termination field.
   m. Pulling tension on 4-pair UTP cables shall not exceed 25 lbf (111 N) for a four-pair UTP cable.
D. Vertical Outlet Pole And Surface Raceway:
1. Horizontal Cabling:
   a. General:
      1) Vertical outlet poles and Surface Raceway refers to surface raceway system used for branch circuit wiring and/or data network, voice, video and other low-voltage cabling.
Surface raceway shall be used in solid wall applications or for applications where moves, additions and changes are very typical to workflow.

b. Raceway system shall consist of raceway, appropriate fittings and accessories to complete installation per electrical Contract Documents. Non-metallic surface raceway is to be utilized in dry interior locations only as covered in Article 352, part B of the NEC, as adopted by the NFPA and as approved by the ANSI.

E. Copper Termination Hardware:
1. Cables shall be dressed and terminated in accordance with TIA-568, Manufacturer's recommendations, and best industry practices.
2. Pair untwist at termination shall not exceed 0.125 inch (3.175 mm).
   a. Bend radius of cable in termination area shall not be less than 4 times outside diameter of cable.
3. Cables shall be neatly bundled and dressed to their respective panels or blocks.
   a. Each panel or block shall be fed by individual bundle separated and dressed back to point of cable entrance into rack or frame.
   b. Cables shall be bundled using Velcro straps at least 0.25 inch (6.35 mm) wide. Use of plastic wire ties or zip ties is not allowed on project.
4. Cable jacket shall be maintained as close as possible to termination point.
5. Each cable shall be clearly labeled on cable jacket behind patch panel at location that can be viewed without removing bundle Velcro support straps.
   a. Cables labeled within bundle, where label is obscured from view shall not be acceptable.

F. Grounding System:
1. Where required, Telecommunications Bonding Backbone shall be designed and/or approved by qualified Installer.
2. Follow requirements of TIA-607.

G. Seismic Bracing:
1. Comply with IBC and local seismic requirements for all equipment and conduit pathways.

H. Identification and Labeling:
1. Apply machine generated approved labeling for racks, cables, panels and outlets:
   a. Designate cables origin and destination and unique identifier for cable by room name and/or number and port count.
   b. Racks and patch panels shall be labeled to identify location within cable system infrastructure.
2. Place labeling within view at termination point on each end.
3. Outlet, patch panel and wiring block labels shall be installed on, or in, space provided on device.
5. Conform to IP addressing assignments as listed in Attachment ‘FACILITIES ZONE IP ADDRESS ASSIGNMENT TABLE’.
   a. See Attachment ‘FACILITIES ZONE IP ADDRESS ASSIGNMENT TABLE’ for ‘IPAddress Assignments’.

3.2 FIELD QUALITY CONTROL
A. Field Tests:
1. Provide testing upon completion of installation.
   a. General:
      1) Testing to be in accordance with TIA standards and Manufacturer's system warranty guidelines and best industry practice.
      a) If any of these are in conflict, discrepancies shall be brought to attention of Architect/Consulting Engineer for clarification and resolution.
   b. Cables and termination hardware:
      1) Test complete system for defects in installation.
2) Verify cabling system performance under installed conditions according to requirements of TIA-568:
   a) All pairs of each installed cable shall be verified prior to system acceptance.
   b) Any defect in cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure one hundred (100) percent useable conductors in all cables installed.

c. Copper channel testing:
   1) All twisted-pair copper cable links shall be tested for compliance to requirements of TIA-568 for appropriate Category of cabling installed.
   2) Backbone multimode fiber cabling shall be tested at both 850 nm and 1300 nm.

d. UTP Cables and Links testing:
   1) UTP cabling channel must be tested at swept frequencies up to 250 MHz for internal channel performance parameters as defined in IEEE 802.3 and TIA-568. Certifications shall include following parameters for each pair of each cable installed:
      a) Wire map (pin to pin connectivity).
      b) Length (in feet or millimeters).
      c) Near End Crosstalk (NEXT).
      d) Far End Crosstalk (FEXT).
      e) ELFEXT.
      f) Attenuation/Crosstalk Ration (ACR).
      g) Return Loss.
      h) Propagation Delay.
      i) Delay Skew.
      j) Test equipment shall provide electronic and printed record of these tests.
   2) Test each pair of cable for opens, shorts, grounds, and pair reversal.
      a) Correct short or grounded and reversed pairs.
      b) Examine open and shorted pairs to determine if problem is caused by improper termination.
      c) If termination is proper, tag bad pairs at both ends and note on termination sheets.
      d) If horizontal cable contains bad conductors, remove and replace cable.

e. Testing Equipment:
   1) Comply with requirements of TIA-568.
      a) Appropriate level III tester shall be used to verify Category 6 cabling systems.
   2) UTP Cables and Links test equipment:
      a) Category Four Approved Testing Equipment. See Section 01 6200 for definitions of Categories:
         (1) Fluke Networks DTX-1800 with firmware version 2.04 or later.
             (a) Test lead to be P/N DTX-PLA001 or PLA002 universal permanent link interface adapter.
         (2) Agilent Wirescope Pro N2640A with firmware version 2.1.9 or later.
             (a) Test lead to be P/N N2644A-101 universal CAT6A link smart probes.

f. Re-Testing:
   1) Consulting Engineer mayrequest ten (10) percent random field re-test to be conducted on cable system, at no additional cost to Owner, to verify documented findings.
      a) Tests shall be repeat of those defined above.
      b) If findings contradict documentation submitted, additional testing can be requested to extent determined necessary by Consulting Engineer, including one hundred (100) percent re-test at no additional cost to Owner.

g. Tests And Evaluation Reports:
   1) Printouts generated for each cable by wire test instrument shall be submitted as part of documentation package. Installer may furnish this information in electronic form.
      a) Media shall contain electronic equivalent of test results as defined by the Section along with software necessary to view and evaluate test reports.
   2) Submit documentation within ten (10) working days of completion of each testing phase. This is inclusive of all test results and record drawings.
   3) Draft drawings may include annotations done by hand. Final copies of all drawings shall be submitted within thirty (30) working days of completion of each testing phase.
   4) If requested by Consulting Engineer, provide copies of original test results.
h. Test Documentation:
   1) Provide electronic format documentation within three (3) weeks after completion of project.
   2) Documentation shall be clearly marked on outside front cover with following:
      a) "Project Test Documentation".
      b) Project name.
      c) Date of completion (month and year).
   3) Test results shall include following:
      a) Record of test frequencies.
      b) Cable type.
      c) Conductor pair and cable (or outlet) I.D.
      d) Measurement direction.
      e) Reference setup.
      f) Crew member name(s).
      g) Test equipment name, manufacturer, model number, serial number, software version.
      h) Last calibration date:
         (1) Unless Manufacturer specifies more frequent calibration cycle, annual calibration cycle is required on all test equipment used on project.
         (2) Document shall detail test method used and specific settings of equipment during test as well as software version being used in field test equipment.

B. Non-Conforming Work: Non-conforming work as covered in General Conditions applies, but is not limited to following:
   1. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced at no additional cost to Owner.
   2. Any defect in cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure one hundred (100) percent useable conductors in all cables installed at no additional cost to Owner.
   3. Correct deviation and repeat applicable testing at no additional cost to Owner.
   4. Correct any work found defective or not complying with Association Publications and TDMM requirements at no additional cost to Owner.
      a. Document all problems found and corrective action taken.
      b. Include both failed and passed test data.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install complete and operational video system as described in Contract Documents including:
      a. Line amplifiers, video and audio processors, video switchers, cable, connectors and ancillary equipment necessary to successful reception and distribution of video and audio signal from selected reception device (satellite and/or video stream).
      b. Installation and testing of Owner Furnished Network Streaming Equipment.
   2. Assist Audiovisual Consultant with final inspection of system and provide necessary test equipment. Correct problems found at time of final inspection of system.

B. Related Requirements:
   1. Division 26: 'Electrical':
      a. Power to equipment location.
   2. Section 26 0533: 'Raceway And Boxes For Electrical Systems' for raceway and boxes for video wiring.
   3. Section 27 1116: 'Communications Cabinet, Racks, Frames, and Enclosures'.
   4. Section 27 5117: 'Audio Systems'.
   5. Instructions to Owner by Audiovisual Consultant.
   6. Audiovisual Consultant will perform final inspection and instruct local leaders in operation of system.

C. Products Furnished But Not Installed Under This Section:
   1. Steel base pipe for satellite system.

D. Related Requirements:
   1. Section 03 3111: 'Cast-In-Place Structural Concrete' for installation of concrete base pier for base pipe.
   2. Section 09 9113: 'Exterior Painted Galvanized Metal' for finish painting of base pipe.

E. Products Installed But Not Furnished Under This Section:
   1. Owner Furnished Network Streaming Equipment as specified on TA (Technology Audiovisual) Drawings as shown in Contract Documents including:
      a. Webcast Communicator or Webcast Capable Device.

F. Related Requirements:
   1. Section 01 6400: Owner will Furnish Network Streaming Equipment as specified on TA (Technology Audiovisual) Drawings as shown in Contract Documents. Contract Documents establishes quality of materials and installation for information of Contractor, Architect, and Owner's Representatives. Design Criteria in PART 2 of this Section identifies Contractor's responsibility for Owner Network Equipment.

1.2 REFERENCES

A. Association Publications:
   2. InfoComm International Association:
   3. Institute of Electrical and Electronics Engineers:
      a. IEEE 1100-2005, 'Recommended Practice for Powering and Grounding Electric Equipment'.

B. Reference Standards:
   1. American National Standards Institute/InfoComm International Association:
   2. ASTM International:
      a. ASTM A53/A53M-18, 'Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless'.
   3. Telecommunications Industry Association:
1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate with Owner’s Representative (Project Manager and/or Facility Manager) well in advance of Substantial Completion for installation of all Owner Furnished Network Streaming Equipment.
   2. Coordinate final inspection schedule of both audio and video systems before Audiovisual Consultant’s final inspection.

B. Schedule:
   1. After completion of video system installation of this section, Installer to perform Field Testing before Audiovisual Consultant Final Inspection of audio system.
   2. Notify Audiovisual Consultant two (2) weeks minimum before Field Inspection specified in Field Quality Control in Part 3 of this specification.

1.4 SUBMITTALS

A. Informational Submittals:
   1. Manufacturer Reports:
      a. Itemized list of equipment to be supplied.
   2. Special Procedure Submittals:
      a. Provide itemized list of equipment to be supplied.
      b. Provide proposed labeling for system components.
   3. Qualification Statement:
      a. Installer:
         1) Provide Qualification documentation as requested by Engineer/Architect including:
            a) List of Projects requested.
            b) List of certified technician(s) with dates of training courses completed.

B. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Include following items supplied by Audiovisual Consultant at time of final inspection:
            a) System operation and maintenance instructions.
            b) List of equipment provided, including portable equipment, showing make, model, and serial number.
         2) Leave clear plastic sheet protector in rear of equipment cabinet with system drawings and documentation.
         3) Set-up files and settings for video equipment.
      b. Warranty Documentation:
         1) Final, executed copy of Warranty.
      c. Record Documentation:
         1) Manufacturers documentation:
            a) Equipment manufacturer’s manuals and warranty information.

1.5 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. System shall be installed in accordance with applicable standards, requirements, and recommendations of International Building Code, National Electrical Code and all local authorities having jurisdiction.

B. Qualifications:
   1. Installer. Requirements of Section 01 4301 applies, but not limited to following:
      a. Approved Installers:
         1) Installers are to furnish and install components of video system and meet qualification requirements.
         2) Approval subject to agreement process for Pre-Approval Installers.
      b. Alternate Installer(s):
         1) Firm specializing in performing work of this section:
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

Section 27 5117 'Audio Systems'

1.6 DELIVERY, STORAGE, AND HANDLING
A. Delivery And Acceptance Requirements:
   1. Materials shall be delivered in original, unopened packages with labels intact.

B. Storage And Handling Requirements:
   1. Provide secure location protected from weather in cool, dry location, out of direct sunlight in compliance with Manufacturer’s instructions and recommendations.
   2. Keep materials free from dirt and foreign matter.

1.7 WARRANTY
A. Special Warranty:
   1. Provide complete warranty repair or replacement for one (1) year at no cost to Owner, except in case of obvious abuse.
   2. If failure causes Chapel or Cultural Center audio system to be inoperative or unusable for its intended purpose, Installer, when notified of problem before Wednesday, shall repair system so it will be operational and usable by following Sunday. If defective components cannot be repaired in time, furnish and install temporary loaner equipment as required.
   3. Honor component warranties for term established by Manufacturer, if greater than one (1) year.

PART 2 - PRODUCTS
2.1 OWNER-FURNISHED PRODUCTS
A. Category Four Products. See Section 01 6200 for definitions of Categories:
   1. Network Streaming Equipment as specified on TA (Technology Audiovisual) Drawings as shown in Contract Documents including:
      a. Projectors.
      b. Video Monitors.
   2. Coordination:
      a. Coordinate installation of all Owner Furnished Network Streaming Equipment including but not limited to:
         1) Installation and configure devices in accordance with LDS requirements.
         2) Proper set-up of Network Streaming Equipment.
         3) Testing of Network Streaming Equipment.

2.2 SYSTEM
A. Design Criteria:
   1. Video distribution system refers but is not limited to following components:
      a. Line amplifiers, video and audio processors, video switchers, cable, connectors and ancillary equipment necessary to successful reception and distribution of video and audio signal from the selected reception device (video stream).
      b. Owner Furnished Network Streaming Equipment.
   2. Intent of this specification is that receiving system will receive broadcasts from network streaming device and/or satellite currently in use by Church and provide video, audio, and video signal distributed properly throughout system.
   3. System shall be fully function and complete video distribution system using equipment and materials of types, sizes, rating, and performances as indicated in Contract Drawings and following requirements:
      a. Equipment and materials shall comply with manufactures’ standard design and construction in accordance with published product data and in compliance with referenced standards.
      b. Equipment and materials are to be integrated with components and connections functions at optimum performance.
      c. Setup shall be optimized for display resolutions matching owner furnished display devices.
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

B. Manufacturers Contact List:
   1. Category Four Approved Components as shown on Contract Drawings from following manufacturers. See Section 01 6200 for definitions of Categories:
      a. Anderson Manufacturing, Idaho Falls, ID (800) 635-6106 or (208) 523-6460.
      h. EFI Electronics, Salt Lake City, UT www.efinet.com.
      u. Ramko Research Inc, Rancho Cordova, CA (800) 678-1357 or (916) 635-3600.
      x. RMS Electronics Inc, Secaucus, NJ (800) 223-8312 or (201) 288-8833.

C. Materials:
   1. Video Components as specified on TA (Technology Audiovisual) Drawings as shown in Contract Documents.

PART 3 - EXECUTION

3.1 INSTALLERS
   A. Approved Installers:
      1. Category Four Approved Installers. See Section 01 6200 for definitions of Categories:
         a. Qualifications:
            1) Meet qualification requirements as specified in Quality Assurance in Part 1 of this specification.
         b. General Communications: (801) 266-5731.
         d. Poll Sound: (801) 261-2500.
         e. Professional Systems Technology: (801) 649-6696.

3.2 EXAMINATION
   A. Verification Of Conditions:
      1. Verify compliance with following items before beginning work of this Section:
         a. Assure that antenna clears every obstacle and has clear line-of-sight to United States domestic-arc satellites. If there are obstructions, report to Architect before proceeding.
         b. No cables spliced.
         c. Specified cables and equipment cabinets are properly installed.
      2. Verify all site conditions are in compliance with requirements for proper installation and function of video system work.
A. Owner Furnished Equipment:
   1. Network Streaming Equipment:
      a. Install and setup Owner Furnished Network Streaming Equipment.
   2. Extended Display Identification Data (EDID):
      a. Set all specified EDID capable devices for Owner Furnished Display Device resolutions and
          sync signals including installation and setup.

B. General:
   1. Install system in accordance with NFPA 70 'National Electrical Code', NFPA 72 'National Fire
      Alarm and Signaling', and other applicable codes. Install equipment in accordance with
      manufacturer's written instructions.

C. Equipment Cabinet:
   1. File smooth exposed rough edges after cutting and drilling. Do not allow sharp screws to
      protrude from cabinet.
   2. Install vent panels at top and bottom of equipment cabinets. In addition, install vent panels above
      and below satellite receiver and between other components, where possible, for maximum
      ventilation.
   3. Securely fasten equipment plumb and square in place. Utilize all fastening holes in front of
      cabinet.
   4. Securely fasten in place equipment that is not rack mounted, including relays and other small
      components. Do not use sticky-back tape.
   5. Install balancing / isolation transformer when balanced and unbalanced components are
      connected.
   6. Wire XLR-type connections with pin 2 hot, pin 1 shield.
   7. Connect powered components to 120 VAC outlets on voltage suppressor power bars. Do not
      connect to outlets on other components.
   8. Identification:
      a. Legibly identify user-operated system controls and system input/output jacks using
         engraved, permanently attached laminated plastic plates or imprinted Lexan labels. Label
         equipment and controls within equipment cabinets using similar labels or printed labels from
         a label maker or laser printer.
      b. Affix label to rack panel in cabinet listing name and telephone number of installer.
         Appropriate warranty instructions may be included.

D. Cables, Wires, And Connectors:
   1. Cables:
      a. Cable and wire shall be new and unspliced.
      b. Splicing:
         1) Splicing of cables and conductors is expressly prohibited in any location other than
            equipment racks.
         2) Splicing of control and speaker level conductors shall be accomplished via punch block
            or terminal strip connections only.
      c. Additional cable length shall be provided at all connector locations. Duplex box, junction
         box, and floor box locations shall be installed with sufficient cable length behind cover plates
         to permit wiring maintenance and connector replacement in the future.
      d. When cable runs utilize vertical cable raceways located within walls, acoustic integrity of
         walls shall be maintained:
         1) Cables that pass through cover plates of junction boxes and raceways, throughslab-to-
            slab walls, and through conduit lines shall be properly gasketted and sealed. Acoustic
            material shall be restored or replaced.
         e. Separation between system cables and other services shall be maximized to prevent and/or
            minimize potential for electro-magnetic interference (EMI):
            1) Provide at least 12 inches (305 mm) separation from electrical lines whenever feasible.
            2) Where separation is unavoidable, distribution cables shall cross other services at right
               angles whenever practical to minimize EMI.
      f. Do not install signal cables on top of light fixtures, ceiling speakers, video projector lifts,
         projection screens, HVAC controls or sensing devices, fire safety and sprinkler system
         detection technology, or any other technology or mechanical equipment.
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

Do not lay cables directly on top of T-bar grid ceiling tiles:
1) Support cables installed outside of conduit at 4 feet (1.20 m) maximum intervals from building structure.
2) Do not utilize support wires from other trades or systems.

Install system cables shall not block access to other equipment or services, across removable service panels and/or in any other manner to prohibit routine maintenance of HVAC systems, fire safety equipment and building mechanical control systems.

Inter-rack cabling:
1) Inter-rack cabling shall be neatly laced, dressed, strain relieved and adequately supported.
2) Inter-rack cables shall be grouped according to signals being carried to reduce signal contamination. Separate groups shall be formed for following:
   a) Power.
   b) Control.
   c) Video.
   d) Audio cables carrying signals less than -20 dBm.
   e) Audio cables carrying signals between -20 dBm and +20 dBm.
   f) Audio cables carrying signals over +20 dBm.

Power cables, control cables, and high level cables shall be run on left side of equipment racks as viewed from rear. All other cables shall be run on right side of all equipment racks as viewed from rear.

Cables must be cut to electrical length, shall be cut to length dictated by cable run.
Terminal blocks, boards, strips or connectors, shall be furnished by installer for all cables which interface with racks, cabinets, consoles, or equipment modules. Affix terminal blocks, boards, strips or connectors to equipment racks using screws only. Double sided tape will not be accepted.

Shields for audio cables shall be grounded at input end only of various equipment items on system to prevent potential for ground loops.

Wiring and Cabling:
Comply with industry standard circuit polarity and loudspeaker wiring polarity. No cables shall be terminated with polarity reversal between connectors at either end.
System wire, after being cut and stripped, shall have wire strands twisted back to their original lay and be terminated by approved soldered or mechanical means. No bare wire ends shall be accepted.
Do not place any wires and cables for this system in any conduit, raceway, wire way or cable tray that is used for mechanical systems of building.
Route all cable and wiring within equipment racks, cabinets and millwork according to function, separating wires of different signal levels (microphone, line level, amplifier output, AC, control, etc.) by as much distance as possible. Neatly arrange, harness and bundle all cable with velcro straps.
After completion of wiring and cable installation, all trough and box covers shall be notched out and grommetted for clearance of various cable bundles, (i.e., separate audio, video, and control). Panel covers shall be screwed back in place and all gaskets shall be restored or replaced.

Connectors:
Provide connectors of type and quality as detailed in Contract Drawings and/or as required to meet minimum bandwidth requirements of equipment to which connectors are terminated. Overall quantity of connectors shall not be limited by quantities indicated in Contract Drawings and shall be provided as required.
No connectors shall be installed in non-accessible locations or used for splicing cables. Connectors shall be new.
Connectors shall incorporate strain relief mechanisms which firmly grip the jacket of connected cables.
Connectors shall be properly polarized to prevent improper seating.
Connectors shall provide appropriate electrical characteristics for circuitry to which they are attached.
Exposed conductors inside of equipment racks shall be dressed with heavy duty neoprene heat-shrink tubing.
Heat-shrink type tubing shall be used to insulate and dress ends of all wire and cables including separate tube for ground or drain wire.
h. Solder connections shall be made with rosin-core solder. Temperature controlled soldering irons rated at least 60 watts shall be used for all soldering work. No soldering guns, gas or butane, or temperature unregulated irons shall be used on job site.

i. Mechanical connections shall be made with approved crimp lugs of correct size and type for connection. Wire nuts shall not be permitted except inside speaker enclosures. Each connector shall be attached with proper size controlled-duty-cycle ratcheting crimper approved by manufacturer.

j. Conventional non-ratcheting type crimping tools are unacceptable, and shall not be used on job site. Presence of such tools on job site shall constitute evidence of mechanical connections made with unauthorized tools and shall provide sufficient grounds for rejection of all mechanical connections in system, and will be considered non-conforming work.

E. Mounting And Securing Equipment:
1. Equipment shall be firmly secured in place unless requirements of portability dictate otherwise.
2. Fastenings and supports shall be adequate to support their loads with safety factor of at least three (3) times weight of equipment being installed.
3. Any structural mounting that is not able to meet this requirement due to specific nature of equipment, manufacturer's requirements or limitations of facility, shall not be installed without prior approval of Engineer.
4. Install all boxes, equipment, hardware, and other materials plumb, level, and square.

F. Millwork:
1. Install technology equipment and support equipment in podium, and other millwork in neat and cosmetically dressed out manner.
2. Saw cuts, holes and recesses into laminates and woodwork shall be straight.
3. Radius and circular cuts shall be consistent, and all uneven surfaces shall be corrected. This shall include use of moldings, grommets, bushings, laminates, and wood products as required to dress out installation of equipment.
4. Verify installation of equipment and panels in technology racks and podiums are completed by using matching screws, hardware and grommets.

G. Technology:
1. Provide sufficient ventilation for adequate cooling of equipment.
2. Install vent rack panels in unused spaces. Install vent panels at top and bottom and above each power amplifier.
3. Securely fasten equipment plumb and square in place. Where equipment is installed in rack cabinets, utilize all fastening holes and cover open spaces with perforated panels.
4. Securely fasten relays and small components. Do not use sticky-back tape for fasteners.
5. Install balancing transformer on each unbalanced input or output that connects to devices outside equipment cabinet, or that connects to balanced input or output within equipment cabinet.
6. Connect powered components to 120 VAC outlets on transient voltage surge suppressors. Do not connect to outlets on other components.
7. Leave sufficient service loops to uniform length on cables to allow operation of system with chassis outside cabinet.
8. Equipment shall be held firmly in place with proper types of mounting hardware as recommended and/or supplied by manufacturer:
   a. Mounting hardware provided with equipment shall be used when practical. This shall include, but not be limited to, front and rear rack rails, angle brackets and rack mount kits.
   b. Equipment shall be installed so as to provide reasonable safety to operator.
   c. only input selection and volume controls.

3.4 FIELD QUALITY CONTROL
A. Field Tests:
1. Installer Testing:
   a. Upon completion of installation and before inspection by Audiovisual Consultant, test functions verifying following. Make necessary corrections:
      1) System is free from hum, noise, ghosting, loose parts and poor construction or soldering.
      2) Video signals shall be clear, sharp, noise-free picture with good chroma and undistorted, noise free audio.
      3) Audio to sound system is undistorted and noise free.
   b. Complete documentation required by Audiovisual Consultant and submit to consultant within five (5) days of Substantial Completion.
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

B. Field Inspections:
   1. Audiovisual Consultant Inspection:
      a. Coordinate final inspection schedule with Audiovisual Consultant two (2) weeks minimum before Consultant's final inspection.
      b. Have copy of Installer redlined documents sent to Audiovisual Consultant two (2) weeks minimum to before field inspection.
      c. Provide following test equipment in good working order:
         1) Digitally generated video test signal generator:
            a) Generator shall provide minimum of but not be limited to industry standard test signals including color bar patterns, grey scale, alternating pixel, cross hatch and H-pattern.
            b) Generator shall provide resolutions compatible with all specified video equipment.
            c) Generator shall provide resolutions up to 1920 x 1200.
         2) Digital Volt-Ohmmeter.
         3) Necessary chargers, cable, test leads, adapters and other accessories for test equipment.
      d. Ensure Owner Furnished Display Devices such as projectors and video monitors are available and on site at time of inspections.
      e. Correct minor items so Audiovisual Consultant may certify satisfactory completion without return trip.

C. Non-Conforming Work:
   1. Correct any work found defective or not complying with contract document requirements at no additional cost to the Owner.

D. Manufacturer Services:
   1. Provide services of factory authorized service representative to supervise field assembly and connection of components and pretesting, testing, and adjustment of system.

3.5 CLEANING
A. Waste Management:
   1. All work areas are to be kept clean, clear and free of debris at all times.
   2. Disposal of rubbish, debris, and packaging materials to Contractor provided Dumpster.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY
A. Includes But Not Limited To:
1. Furnish and install complete and operational sound system as described in Contract Documents including:
   a. Complete systems for amplifying sound signals from microphones and media source equipment and distributing them to loudspeakers at various locations.
2. Assist Audiovisual Consultant with final inspection and equalization of system and provide necessary test equipment for audio system and partition noise isolation tests if applicable. Correct problems found at time of final inspection of system.
B. Related Requirements:
1. Division 26 'Electrical':
   a. Raceway, boxes, and installation of speaker enclosures and mounting rings furnished by Division 27.
   b. Power to equipment location and power relay wiring if applicable.
2. Section 27 1116: ‘Communications Cabinet, Racks, Frames, and Enclosures’.
3. Section 27 1501: ‘Communications Horizontal Cabling’.
5. Audiovisual Consultant will perform final inspection, system balance, equalization, and instruct local leaders in operation of system.
C. Products Installed But Not Furnished Under This Section:
1. Webcast Communicator or Webcast Capable Device.
D. Related Requirements:
1. Section 01 6400: Owner will furnish Webcast Communicator or Webcast Capable Device such as personal computer or laptop. This Section establishes quality of materials and installation for information of Contractor, Architect, and Owner's Representatives.

1.2 REFERENCES
A. Association Publications:
2. InfoComm International Association:
3. Institute of Electrical and Electronics Engineers:
   a. IEEE 1100-2005, 'Recommended Practice for Powering and Grounding Electric Equipment'.
B. Reference Standards:
1. American National Standards Institute/InfoComm International Association:
   a. ANSI/INFOCOMM 1M:2009, 'Audio Coverage Uniformity in Enclosed Listener Areas'.
2. National Fire Protection Association:
3. Telecommunications Industry Association:
   b. TIA-569, 'Telecommunications Pathways And Spaces' (Revision D, 2015).
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

4. Underwriters Laboratories (UL):

1.3 ADMINISTRATIVE REQUIREMENTS
A. Coordination:
   1. Coordinate final inspection schedule of both audio and video systems before Audiovisual Consultant's final inspection.

B. Schedule:
   1. After completion of audio system installation of this section, Installer to perform Field Testing before Audiovisual Consultant Final Inspection of audio system.
   2. Notify Audiovisual Consultant two (2) weeks minimum before Audiovisual Consultant's final inspection as specified in Field Quality Control in Part 3 of this specification.

1.4 SUBMITTALS
A. Informational Submittals:
   1. Special Procedure Submittals:
      a. Provide itemized list of equipment to be supplied.
      b. Provide proposed labeling for system components.
   2. Qualification Statement:
      a. Installer:
         1) Provide Qualification documentation as requested by Engineer/Architect including:
            a) List of Projects requested.
            b) List of certified technician(s) with dates of training courses completed.
   B. Closeout Submittals:
      1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
         a. Operations and Maintenance Data:
            1) Equipment Manufacture's manual:
               a) Audio system operation and maintenance instructions.
               b) List of equipment provided, including portable equipment, showing make, model, and serial number.
         b. Warranty Documentation:
            1) Include copy of final, executed warranty.
         c. Record Documentation:
            1) Software and Programming: Copies of all manufacturers’ software used for programming various components and functions of the system shall be furnished to the Owner:
               a) Original audio processor program files, source codes and compiled codes used for system control, audio setup and any other computerized functions of system including screen layout generation, configuration and layouts and any other related computer files shall also be furnished to Owner.
               b) In each and every case, all programming, code generation, configuration files, layout files and any other software and/or code written and generated of setup and operation of this system are property of Owner of system and not of Audiovisual Consultant, Contractor or Integrator.

1.5 QUALITY ASSURANCE
A. Regulatory Agency Sustainability Approvals:
   1. System shall be installed in accordance with applicable standards, requirements, and recommendations of International Building Code, National Electrical Code and all local authorities having jurisdiction.

B. Qualifications:
   1. Installer. Requirements of Section 01 4301 applies, but not limited to following:
      a. Approved Installers:
         1) Installers are to furnish and install components of audio system and meet qualification requirements.
         2) Approval subject to agreement process for Pre-Approval Installers.
      b. Alternate Installer(s):
         1) Firm specializing in performing work of this section:
            a) Minimum three (3) years of successful installation experience of AV system projects of comparable size, and complexity required for this project. Audio systems must have included complete installation and setup work and must have been completed by factory trained and certified technician.
            b) Firm successfully completed minimum of three (3) projects in past two (2) years before bidding.
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

Firms must have certified technician that has successfully completed all relevant training courses recommended by manufacturers and proficient of all specified equipment of this section.

d) Comply with specifications and Contract Documents.

2) Submit documentation of compliance of qualifications before bid to Architect or Owner's Representative.

c. Same Approved Installer shall furnish and install components of Section 27 1116 'Communications Cabinets, Racks, Frames and Enclosures' and Section 27 4117 'Video Systems'.

1.6 DELIVERY, STORAGE, AND HANDLING
A. Delivery And Acceptance Requirements:
   1. Materials shall be delivered in original, unopened packages with labels intact.

B. Storage And Handling Requirements:
   1. Provide secure location protected from weather in cool, dry location, out of direct sunlight in compliance with Manufacturer's instructions and recommendations.
   2. Keep materials free from dirt and foreign matter.

1.7 WARRANTY
A. Special Warranty:
   1. Provide complete warranty repair or replacement for one (1) year at no cost to Owner, except in case of obvious abuse.
   2. If failure causes Chapel or Cultural Center audio system to be inoperative or unusable for its intended purpose, Installer, when notified of problem before Wednesday, shall repair system so it will be operational and usable by following Sunday. If defective components cannot be repaired in time, furnish and install temporary loaner equipment as required.
   3. Honor component warranties for term established by Manufacturer, if greater than one (1) year.

PART 2 - PRODUCTS
2.1 OWNER-FURNISHED PRODUCTS
A. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
   1. Webcast Communicator or Webcast Capable Device.

2.2 SYSTEM
A. Manufacturers Contact List:
   1. Category Four components as shown on Drawings from following Manufacturers. See Section 01 6200 for definition of Categories.
      g. COMTEK Inc, Salt Lake City, UT www.comtek.com.
      r. JBL Professional, Northridge, CA www.jblpro.com.
      s. König & Meyer, Wertheim, Germany www.k-m.de/en.
      w. Middle Atlantic Products, Fairfield, NJ www.middleatlantic.com.
B. Performance:
   1. Capabilities:
      a. Installations with audio DSP shall meet following performance parameters:
         1) From 100 Hz to 2 kHz, flat within plus or minus 2 dB.
         2) Above 2 kHz, slope down along an approximate 3 dB per octave slope to 8 kHz.
      b. No noise, hum, RFI pickup or distortion shall be audible under normal operating conditions.
      c. Audio systems shall reproduce program material at level of 80 to 85 dBA without audible distortion.
      d. All input levels shall be pre-set so system may be operated without going into feedback under normal conditions.
      e. Seat-to-seat variations in the 4kHz octave band shall not exceed plus or minus 2 dB in the Chapel or Cultural Center.
      f. Sound masking system:
         1) Sound masking system shall provide adequate speech privacy in Corridor when set between 42 dBA and 46 dBA at ear-height under speaker so conversation in Office at slightly raised voice levels cannot be understood in Corridor.

C. System Requirements:
   1. General:
      a. Provide complete and fully functional audio systems using materials and equipment of types, sizes, ratings, and performances as indicated in equipment list in accompanying drawings:
         1) Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction in accordance with published product information.
         2) Coordinate features of materials and equipment so they form integrated system with components and interconnections matched for optimum performance of specified functions.
      b. Provide all wire, cable, and connectors as required to complete installation of all systems as designed and specified.

D. Equipment And Materials:
   1. General:
      a. Provide equipment selected from equipment list on drawings, or as substituted following proscribed substitution process, using all solid state components fully rated for continuous duty at ratings indicated or specified.
      b. Select equipment for normal operation on input power supplied at 105 130 V, 60 Hz.

PART 3 - EXECUTION
3.1 INSTALLERS
   A. Approved Installers:
      1. Category Four Approved Installers. See Section 01 6200 for definitions of Categories:
         a. Qualifications:
            1) Meet qualification requirements as specified in Quality Assurance in Part 1 of this specification.
            b. General Communications: (801) 266-5731.
            d. Poll Sound: (801) 261-2500.
            e. Professional Systems Technology: (801) 649-6696.

3.2 EXAMINATION
   A. Verification Of Conditions:
      1. Verify compliance with following items before beginning work of this Section:
         a. No cables spliced.
         b. Isolated ground run back to electrical panel from all equipment cabinets.
         c. Specified conduit, cables, speaker enclosures and equipment cabinets are properly installed.
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

3.3 INSTALLATION

A. General:
1. Install system in accordance with NFPA 70 ‘National Electrical Code’, NFPA 72 ‘National Fire Alarm and Signaling’, and other applicable codes. Install equipment in accordance with
   manufacturer’s written instructions.

B. Mounting And Securing Equipment:
1. Equipment shall be firmly secured in place unless requirements of portability dictate otherwise.
2. Fastenings and supports shall be adequate to support their loads with safety factor of at least
   three (3) times weight of equipment being installed.
3. Any structural mounting that is not able to meet this requirement due to specific nature of
   equipment, manufacturer's requirements or limitations of facility, shall not be installed without
   prior approval of Engineer.
4. Install all boxes, equipment, hardware, and other materials plumb, level, and square.

C. Millwork:
1. Install technology equipment and support equipment in millwork in neat and cosmetically dressed
   out manner.
2. Install technology equipment and support equipment in podium and other millwork in neat and
   cosmetically dressed out manner.
3. Saw cuts, holes and recesses into laminates and woodwork shall be straight.
4. Radius and circular cuts shall be consistent, and all uneven surfaces shall be corrected. This
   shall include use of moldings, grommets, bushings, laminates, and wood products as required to
   dress out installation of equipment.
5. Install equipment and panels in technology racks and podiums using matching screws, hardware
   and grommets.

D. Speakers:
1. Maintain uniform polarity in speakers and wiring.
2. Employ no positive stop in rotation of speaker volume controls. Controls shall be capable of
   continuous rotations in either direction.
3. Mount transformers with screws securely to speaker brackets or enclosures. Adjust torsion
   springs as necessary to securely support speaker assembly.
4. Neatly mount speaker grilles, panels, connector plates, control panels, etc., tight, plumb, and
   square unless indicated otherwise on drawings.
5. Provide brackets, screws, adapters, springs, rack mounting kits, etc., recommended by
   manufacturer for correct assembly and installation of speaker assemblies and electronic
   components.
6. Line factory-fabricated speaker back boxes with one inch (25 mm) minimum fiberglass if not done
   by Back box Manufacturer.
7. Speaker Back Boxes shall be secured to structure using 12 ga (2.7 mm) minimum seismic safety
   cables.

E. Technology:
1. Provide sufficient ventilation for adequate cooling of equipment.
2. Install vent rack panels in unused spaces. Install vent panels at top and bottom and above each
   power amplifier.
3. Securely fasten equipment plumb and square in place. Where equipment is installed in rack
   cabinets, utilize all fastening holes and cove open spaces with perforated panels.
4. Securely fasten relays and small components. Do not use sticky-back tape for fasteners.
5. Install balancing transformer on each unbalanced input or output that connects to devices outside
   equipment cabinet, or that connects to balanced input or output within equipment cabinet.
6. Connect powered components to 120 VAC outlets on transient voltage surge suppressors. Do
   not connect to outlets on other components.
7. Leave sufficient service loops to uniform length on cables to allow operation of system with
   chassis outside cabinet.
8. Equipment shall be held firmly in place with proper types of mounting hardware as recommended
   and/or supplied by manufacturer:
   a. Mounting hardware provided with equipment shall be used when practical. This shall
      include, but not be limited to, front and rear rack rails, angle brackets and rack mountkits.
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

b. Equipment shall be installed so as to provide reasonable safety to operator.

F. Cables, Wires, And Connectors:
   1. Cables:
      a. Cable and wire shall be new and unspliced.
      b. Splicing:
         1) Splicing of cables and conductors is expressly prohibited in any location other than
            equipment racks.
         2) Splicing of control and speaker level conductors shall be accomplished via punch block
            or terminal strip connections only.
      c. Additional cable length shall be provided at all connector locations. Duplex box, junction
         box, and floor box locations shall be installed with sufficient cable length behind coverplates
         to permit wiring maintenance and connector replacement in the future.
      d. When cable runs utilize vertical cable raceways located within walls, acoustic integrity of
         walls shall be maintained:
         1) Cables that pass-through cover plates of junction boxes and raceways, through slab-to-
            slab walls, and through conduit lines shall be properly gasketted and sealed. Acoustic
            material shall be restored or replaced.
      e. Separation between system cables and other services shall be maximized to prevent and/or
         minimize potential for electro-magnetic interference (EMI):
         1) Provide at least 12 inches (305 mm) separation from electrical lines whenever feasible.
         2) Where separation is unavoidable, distribution cables shall cross other services at right
            angles whenever practical to minimize EMI.
      f. Do not lay cables directly on top of T-bar grid ceiling tiles:
         1) Support cables installed outside of conduit at 4 feet (1.20 m) maximum intervals from
            building structure.
         2) Do not utilize support wires from other trades or systems.
      g. Install system cables shall not block access to other equipment or services, across
         removable service panels and/or in any other manner to prohibit routine maintenance of
         HVAC systems, fire safety equipment and building mechanical control systems.
      i. Inter-rack cabling:
         1) Inter-rack cabling shall be neatly laced, dressed, strain relieved and adequately
            supported.
         2) Inter-rack cables shall be grouped according to signals being carried to reduce signal
            contamination. Separate groups shall be formed for following:
            a) Power.
            b) Control.
            c) Video.
            d) Audio cables carrying signals less than -20 dBM.
            e) Audio cables carrying signals between -20 dBM and +20 dBM.
            f) Audio cables carrying signals over +20 dBM.
      j. Power cables, control cables, and high-level cables shall be run on left side of equipment
         racks as viewed from rear. All other cables shall be run on right side of all equipment racks
         as viewed from rear.
      k. Cables, except video cables which must be cut to electrical length, shall be cut to length
         dictated by cable run.
      l. Terminal blocks, boards, strips or connectors, shall be furnished by installer for all cables
         which interface with racks, cabinets, consoles, or equipment modules. Affix terminal blocks,
         boards, strips or connectors to equipment racks using screws only. Double sided tape will
         not be accepted.
      m. Shields for audio cables shall be grounded at input end only of various equipment items on
         system to prevent potential for ground loops.
      n. Shields for microphone cables shall be grounded at both ends to allow Phantom Power to
         pass.
   2. Wiring and Cabling:
      a. Comply with industry standard circuit polarity and loudspeaker wiring polarity. No cables
         shall be terminated with polarity reversal between connectors at either end.
      b. System wire, after being cut and stripped, shall have wire strands twisted back to their
         original lay and be terminated by approved soldered or mechanical means. No bare wire
ends shall be accepted.

c. Do not place any wires and cables for this system in any conduit, raceway, wire way or cable tray that is used for mechanical systems of building.

d. Route all cable and wiring within equipment racks, cabinets and millwork according to function, separating wires of different signal levels (microphone, line level, amplifier output, AV, control, etc.) by as much distance as possible. Neatly arrange, harness and bundle all cable with velcro straps.

e. After completion of wiring and cable installation, all trough and box covers shall be notched out and grommetted for clearance of various cable bundles, (i.e., separate audio, video, and control). Panel covers shall be screwed back in place and all gaskets shall be restored or replaced.

3. Connectors:

a. Provide connectors of type and quality as detailed in Contract Drawings and/or as required to meet minimum bandwidth requirements of equipment to which connectors are terminated. Overall quantity of connectors shall not be limited by quantities indicated in Contract Drawings and shall be provided as required.

b. No connectors shall be installed in non-accessible locations or used for splicing cables. Connectors shall be new.

c. Connectors shall incorporate strain relief mechanisms which firmly grip the jacket of connected cables.

d. Connectors shall be properly polarized to prevent improper seating.

e. Connectors shall provide appropriate electrical characteristics for circuitry to which they are attached.

f. Exposed conductors inside of equipment racks shall be dressed with heavy duty neoprene heat-shrink tubing.

g. Heat-shrink type tubing shall be used to insulate and dress ends of all wire and cables including separate tube for ground or drain wire.

h. Solder connections shall be made with rosin-core solder. Temperature controlled soldering irons rated at least 60 watts shall be used for all soldering work. No soldering guns, gas or butane, or temperature unregulated irons shall be used on job site.

i. Mechanical connections shall be made with approved crimp lugs of correct size and type for connection. Wire nuts shall not be permitted except inside speaker enclosures. Each connector shall be attached with proper size controlled-duty-cycle ratcheting crimp tool approved by manufacturer.

j. Conventional non-ratcheting type crimping tools are unacceptable, and shall not be used on job site. Presence of such tools on job site shall constitute evidence of mechanical connections made with unauthorized tools and shall provide sufficient grounds for rejection of all mechanical connections in system, and will be considered non-conforming work.

G. Equipment Cabinet:

1. Install vent panels at top and bottom of equipment cabinets and between components where possible for maximum ventilation. Locate amplifiers at top of cabinet. Locate equalizers below amplifiers, separated by several vent panels.

2. Securely fasten equipment plumb and square in place. Utilize all fastening holes in front of cabinet.

3. Securely fasten in place equipment that is not rack mounted, including relays and other small components. Do not use sticky-back tape.

4. Install balancing / isolation transformer when balanced and unbalanced components are connected.

5. Wire XLR-type connections with pin 2 hot, pin 1 shield.

6. Connect powered components to 120 VAC outlets on voltage suppressor power bars. Do not connect to outlets on other components.

7. Identification:

a. Legibly identify user-operated system controls and system input / output jacks using engraved, permanently attached laminated plastic plates or imprinted Lexan labels. Label equipment and controls within equipment cabinets using similar labels or printed labels from a label maker or laser printer.

b. Affix label to rack panel inside cabinet listing name and telephone number of installer. Appropriate warranty instructions may be included.

H. Identification And Labeling:

1. Cables, regardless of length, shall be identified with machine-printed wrap-around labeling system at both ends:
The Church of Jesus Christ of Latter-day Saints  
Garden City Assembly Hall

2. Audio Systems

   a. These labels shall be self-laminating to ensure durability.
   b. Label format used shall be equal, or better than, system detailed.

2. There shall be no unmarked cables any place in system.

3. Marking codes used on cables shall correspond to codes provided with submittals, and/or written documentation of ‘Record Drawings’.

4. Connectors, controls, equipment components, terminal blocks and equipment racks are to be permanently labeled in format approved during submittal process.

5. Equipment labels are to be permanently engraved in metal. Alternative method shall be approved during submittal process only.

6. Clearly and permanently label all jacks, controls, connections, and so forth. Embossed or printed label tape shall not be used and is considered unacceptable for this system. Attach labels with double stick tape as required.

7. Labeling shall be completed prior to acceptance of final system.

I. Grounding:

   1. Provide equipment grounding connections for audio system as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A-486B to assure permanent and effective grounds.
   2. Ground equipment, conductor, and cable shields to eliminate shock hazard and to eliminate ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5 ohm ground at main equipment location. Measure, record, and report ground resistance.

J. Pulpit:

   1. Install pulpit microphone pre-amplifier to be accessible below lectern. Do not alter factory supplied microphone cable and connectors.
   2. Install pulpit microphone so tip of microphone head is 2 inches (50 mm) inside edge of lectern when microphone is tilted down to maximum extent.

K. Seismic Bracing:

   1. Comply with IBC and local seismic requirements for all equipment and conduit pathways.

3.4 FIELD QUALITY CONTROL

A. Field Tests:

   1. Installer Testing:
      a. After completion of installation but before inspection by Audiovisual Consultant, perform following:
         1) Conduct system tests and make necessary corrections for proper system operation including, but not limited to, following:
            a) Output level uniformity.
            b) Polarity.
            c) Shock, strain excited hum, and oscillation.
            d) Clipping, hum, noise, and RFI in all system configurations.
            e) Speaker line impedances.
            f) Loose parts and poor workmanship or soldering.
         2) Sweep speaker systems with high-level sine wave or 1/3 octave pink noise source. Correct causes of buzzes or rattles related to speakers or enclosures. Notify Contractor and Audiovisual Consultant of external causes of buzzes or rattles.
         3) Rough Balance: Balance system well enough that it can be used for meetings before final inspection.
      b. Complete documentation required by Audiovisual Consultant and submit to consultant within five (5) days of Substantial Completion.

B. Field Inspections:

   1. Audiovisual Consultant Inspection And Equalization:
      a. Coordinate final inspection schedule with Audiovisual Consultant two (2) weeks minimum before Consultant's final inspection.
      b. Have copy of Installer redlined documents sent to Audiovisual Consultant two (2) weeks minimum to before field inspection.
      c. Have loose equipment (microphones, cables, etc.) available at time of inspection.
      d. Assist Audiovisual Consultant in final inspection of completed system.
      e. Assist Audiovisual Consultant in noise isolation testing of folding partitions and office doors.
      f. Provide following test equipment in good working order:
         1) Laptop computer:
            a) Operating System: Microsoft Window 7.
2) Processor: 2 GHz Dual-Core Intel Processor or faster (or compatible).
3) RAM: 2 GB or greater.
4) Video: Graphics processor with 128 M dedicated video RAM, minimum 1024x768 display or better.
5) Sound Hardware: Audio Hardware with OS compatible ASIO, Wav/WDB drivers, sample rate of up to 192kHz and bit-resolutions of up to 32 Bit or better.

2) 1/3 octave real-time audio spectrum analyzer with SPL meter, and precision microphone.
3) Digitally generated random pink noise generator, 20Hz-20KHz, minimum two (2) hour repetition rate or ten (10) minutes minimum of equivalent signal recorded on compact disc.
4) Direct reading audio impedance meter, minimum three (3) frequencies, and ten (10) percent accuracy.
5) Digital Volt-Ohmmeter.
6) Audio oscillator, variable frequency, 20Hz-20KHz.
7) MP3 player with pre-recorded speech and music program material.
8) Necessary chargers, cables, test leads, adapters, and other accessories for test equipment.
9) Tools and spare parts for making adjustments and corrections to system.
10) CAT-5 / RJ-45 continuity tester similar to Ideal 62-200 or Amprobe DCT-300.

g. Correct minor items so Audiovisual Consultant may certify satisfactory completion during his visit.

C. Non-Conforming Work:
1. Correct any work found defective or not complying with contract document requirements at no additional cost to the Owner.

D. Manufacturer Services:
1. Provide services of factory authorized service representative to supervise field assembly and connection of components and pretesting, testing, and adjustment of system.

3.5 CLEANING
A. Waste Management:
1. All work areas are to be kept clean, clear and free of debris at all times.
2. Disposal of rubbish, debris, and packaging materials to Contractor provided Dumpster.

END OF SECTION

ATTACHMENTS
MEETINGHOUSE SOUND SYSTEM FUNCTIONALITY
Each of the sound system(s) should function as indicated

CHAPEL SYSTEM

‘CP’ shall be equipped with pulpit Up/Down buttons, Room Volume step up/down buttons, LED’s to provide user feedback of relative volume level. Power On/Off button, and power LED. Each time the system is turned on, the system will shall:

- restore the system to its default settings, and,
- illuminate the middle sound level LED, which corresponds to the default sound level.
- Trigger the Chapel amplifier relay, wait 3 to 5 seconds, for the amplifier to power up, then unmute the DSP output to the chapel amplifier.
- While the amplifier is powering up, the power LED should flash, indicating that the system is not fully ready.
- After the system is fully ready, the LED should remain on.
- Pulpit Up/Down control
- When the system is activated, the pulpit up/down control shall trigger relays in the pulpit height motor causing it to move up or down within the limits determined by the pulpit manufacturer
- shall not cause an audible pop to be heard over the sound system
- Relays installed by the AV contractor shall not be audible in the vicinity of the pulpit, when being operated.

Volume Level Control

- The volume level control shall allow the user to control the relative volume level of the room within a 10dB range. Steps up from the default level shall be made in 2dB steps. Steps down from the default level shall be made in 3dB steps. Where the manufacture products do not allow steps of different levels, the increasing, and decreasing steps shall be of equal magnitude. The LEDs on the CP shall each correspond to a step location, and shall illuminate to indicate the selected relative sound level.

Default Configuration

- The defaults sound level for the system is 4Db below the feedback level.
- The number of open Mies (NOM) shall be 3.
- The pulpit, and sacrament microphones shall be set to always open.
- Auxiliary feeds from both the video system, and the audio system shall not be included in the NOM calculation.

ASSISTIVE LISTENING SYSTEM (ALS)

The assistive listening system, uses RF frequencies to broadcast an audio feed to compatible receivers. When the chapel sound system is on, the system broadcasts the chapel sound. If the cultural hall system is on, and the chapel is not, the system will broadcast the sound from the cultural hall.
PERIMITER ROOM SYSTEMS, AND THE PERIMITER FEED

The perimeter room systems shall include a speaker and volume control knob, in each meetinghouse foyer area, serving area, as well as other selected rooms. These systems shall be connected to the perimeter feed.

When active, the perimeter feed shall transmit sound to the connected systems and rooms. Connected systems shall include independent room systems, Assistive Listening Systems, and Foyer systems, the perimeter feed shall default to the chapel sound whenever the chapel system is on.
DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 0528 PATHWAYS FOR ELECTRONIC SAFETY AND SECURITY
28 3111 DIGITAL, ADDRESSIBLE, FIRE-ALARM SYSTEM

END OF TABLE OF CONTENTS
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
1. Metal conduits, tubing, and fittings.
2. Nonmetallic conduits, tubing, and fittings.
3. Optical-fiber-cable pathways and fittings.
4. Metal wireways and auxiliary gutters.
5. Surface pathways.
7. Handholes and boxes for exterior underground cabling.
B. Related Requirements:
1. Section 26 0533 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.
2. Section 27 0528 "Pathways for Communications Systems" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving communications systems.

1.3 DEFINITIONS
A. ARC: Aluminum rigid conduit.
B. GRC: Galvanized rigid steel conduit.
C. IMC: Intermediate metal conduit.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS
A. Refer to division 26 section "Raceways and Boxes for Electrical Sections".

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS
A. Refer to division 26 section "Raceways and Boxes for Electrical Sections".

2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS
A. Description: Comply with UL 2024; flexible-type pathway, approved for plenum, riser or general-use installation unless otherwise indicated.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

2.4 METAL WIREWAYS AND AUXILIARY GUTTERS
A. Refer to division 26 section "Raceways and Boxes for Electrical Sections". Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 or Type 3R unless otherwise indicated, and sized according to NFPA 70.
1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.
B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
C. Wireway Covers: Hinged type unless otherwise indicated.
D. Finish: Manufacturer's standard enamel finish.

2.5 BOXES, ENCLOSURES, AND CABINETS
A. Refer to division 26 section "Raceways and Boxes for Electrical Sections".

2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND CABLING
A. Refer to division 26 section "Raceways and Boxes for Electrical Sections".

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION
A. Outdoors: Refer to division 26 section "Raceways and Boxes for Electrical Sections".
B. Indoors: Apply pathway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Physical Damage: GRC. Pathway locations include the following:
   a. Mechanical rooms.
   b. Gymnasiums
3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric-Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: GRC.
6. Pathways for Optical-Fiber or Communications Cable: EMT.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
   C. Minimum Pathway Size: 3/4-inch (21-mm) trade size. Minimum size for optical-fiber cables is 1 inch (27 mm).
   D. Pathway Fittings: Compatible with pathways and suitable for use and location.
      1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
      2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
      3. EMT: Use setscrew or compression, steel cast-metal fittings. Comply with NEMA FB 2.10.
      4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
   E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
   F. Install surface pathways only where indicated on Drawings.
   G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).
3.2 INSTALLATION
   A. Refer to division 26 section “Raceways and Boxes for Electrical Sections” except as modified in this article.
   B. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
   C. Stub-ups to Above Recessed Ceilings:
      1. Use EMT, or RMC for pathways.
      2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
   D. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
      1. 3/4-Inch (21-mm) Trade Size and Smaller: Install pathways in maximum lengths of 50 feet (15 m).
      2. 1-Inch (27-mm) Trade Size and Larger: Install pathways in maximum lengths of 75 feet (23 m).
      3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
3.3 INSTALLATION OF UNDERGROUND CONDUIT
   A. Refer to division 26 section “Raceways and Boxes for Electrical Sections”.
3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES
   A. Refer to division 26 section “Raceways and Boxes for Electrical Sections”.
3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY PENETRATIONS
A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING
A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.7 PROTECTION
A. Protect coatings, finishes, and cabinets from damage and deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section Includes:
   1. Fire-alarm control unit.
   3. System smoke detectors.
   6. Device guards.
   8. Addressable interface device.
B. Related Requirements:
   1. Section 28 0513 "Conductors and Cables for Electronic Safety and Security" for cables and conductors for fire-alarm systems.

1.3 DEFINITIONS
A. EMT: Electrical Metallic Tubing.
B. FACP: Fire Alarm Control Panel.
C. HLI: High Level Interface.
E. PC: Personal computer.
F. VESDA: Very Early Smoke-Detection Apparatus.

1.4 ACTION SUBMITTALS
A. Product Data: For each type of product, including furnished options and accessories.
   1. Include construction details, material descriptions, dimensions, profiles, and finishes.
   2. Include rated capacities, operating characteristics, and electrical characteristics.
B. Shop Drawings: For fire-alarm system.
   1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
   2. Include plans, elevations, sections, details, and attachments to other work.
   3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
   4. Detail assembly and support requirements.
   5. Include voltage drop calculations for notification-appliance circuits.
   6. Include battery-size calculations.
   7. Include input/output matrix.
   8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
   9. Include performance parameters and installation details for each detector.
   10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
   11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
   12. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
      a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
      b. Show field wiring required for HVAC unit shutdown on alarm.
c. Show field wiring and equipment required for HVAC unit shutdown on alarm and
override by firefighters’ control system.
d. Show field wiring and equipment required for HVAC unit shutdown on alarm and
override by firefighters’ smoke-evacuation system.
e. Locate detectors according to manufacturer’s written recommendations.
f. Show air-sampling detector pipe routing.
13. Include voice/alarm signaling-service equipment rack or console layout, grounding
schematic, amplifier power calculation, and single-line connection diagram.
14. Include floor plans to indicate final outlet locations showing address of each addressable
device. Show size and route of cable and conduits and point-to-point wiring diagrams.
C. General Submittal Requirements:
1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to
Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
a. Trained and certified by manufacturer in fire-alarm system design.
b. NICET-certified, fire-alarm technician; Level III minimum.
c. Licensed or certified by authorities having jurisdiction.
D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in
addition to submittals listed above, indicate compliance with performance requirements and
design criteria, including analysis data signed and sealed by the qualified professional engineer
responsible for their preparation.
1. Drawings showing the location of each notification appliance and smoke and heat detector,
ratings of each, and installation details as needed to comply with listing conditions of the
device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of
detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals
and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.5 INFORMATIONAL SUBMITTALS
A. Qualification Data: For Installer.
B. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from
manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of
assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and
describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based
and their installation requirements.
C. Field quality-control reports.

1.6 Sample Warranty: For special warranty.
1.7 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For fire-alarm systems and components to include in
emergency, operation, and maintenance manuals.
1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data,"
include the following and deliver copies to authorities having jurisdiction:
a. Comply with the "Records" section of the "Inspection, Testing and Maintenance"
chapter in NFPA 72.
b. Provide “Fire Alarm and Emergency Communications System Record of Completion
Documents” according to the “Completion Documents” Article in the
"Documentation" section of the "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between all devices and equipment.
Each conductor shall be numbered at every junction point with indication of
origination and termination points.
d. Riser diagram.
e. Device addresses.
The Church of Jesus Christ of Latter Day Saints
Garden City Assembly Hall

f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.

g. Record copy of site-specific software.

h. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
   1) Equipment tested.
   2) Frequency of testing of installed components.
   3) Frequency of inspection of installed components.
   4) Requirements and recommendations related to results of maintenance.
   5) Manufacturer's user training manuals.

i. Manufacturer's required maintenance related to system warranty requirements.

j. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:
   1. Software operating and upgrade manuals.
   2. Program Software Backup: On magnetic media or compact disk, complete with data files.
   3. Device address list.
   4. Printout of software application and graphic screens.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
   2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
   3. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
   4. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
   5. Keys and Tools: One extra set for access to locked or tamperproofed components.
   6. Audible and Visual Notification Appliances: One of each type installed.
   7. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.

C. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and voice/strobe evacuation.

C. Automatic sensitivity control of certain smoke detectors.

D. All components provided shall be listed for use with the selected system.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices:
   2. Heat detectors.
   3. Smoke detectors.
   4. Low temperature sensors
5. Automatic sprinkler system water flow.

B. Fire-alarm signal shall initiate the following actions:
   1. Continuously operate alarm notification appliances, including voice evacuation notices.
   2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
   3. Transmit an alarm signal to the remote alarm receiving station.
   4. Activate voice/alarm communication system.
   5. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
   6. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:
   1. Valve supervisory switch.
   2. User disabling of zones or individual devices.
   3. Loss of communication with any panel on the network.

D. System trouble signal initiation shall be by one or more of the following devices and actions:
   1. Open circuits, shorts, and grounds in designated circuits.
   2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
   3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
   4. Loss of primary power at fire-alarm control unit.
   5. Ground or a single break in internal circuits of fire-alarm control unit.
   6. Abnormal ac voltage at fire-alarm control unit.
   7. Break in standby battery circuitry.
   8. Failure of battery charging.
   9. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Supervisory Signal Actions:
   1. Initiate notification appliances.
   2. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
   3. Transmit system status to building management system.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2.4 FIRE-ALARM CONTROL UNIT

A. Subject to the project requirements, provide products by one of the following:
   6. Equal as approved by Architect before bidding. See Section 01 6200.

B. General Requirements for Fire-Alarm Control Unit:
   1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
      a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
      b. The FACP shall be listed for connection to a central-station signaling system service.
      c. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.
2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.

3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
   1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
   2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

D. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
   1. Annunciator and Display: Liquid-crystal type, two line(s) of 40 characters, minimum.
   2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

E. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
   1. Pathway Class Designations: NFPA 72, Class B.
   2. Pathway Survivability: Level 0.
   3. Install no more than 50 addressable devices on each signaling-line circuit.

F. Notification-Appliance Circuit:
   1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
   2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
   3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

G. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

H. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided.
   1. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711.
      a. Allow the application of, and evacuation signal to, indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
      b. Programmable tone and message sequence selection.
      c. Standard digitally recorded messages for "Evacuation" and "All Clear."
      d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of fire-alarm control unit.
   2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
   3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

I. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals and shall be powered by 24-V dc source.
   1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
J. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

2.5 MANUAL FIRE-ALARM BOXES
A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
   1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
   2. Station Reset: Key- or wrench-operated switch.
   3. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.

2.6 SYSTEM SMOKE DETECTORS
A. General Requirements for System Smoke Detectors:
   1. Comply with UL 268; operating at 24-V dc, nominal.
   2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
   3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
   4. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
   5. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.

B. Photoelectric Smoke Detectors:
   1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
   2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
      a. Primary status.
      b. Device type.
      c. Present average value.
      d. Present sensitivity selected.
      e. Sensor range (normal, dirty, etc.).

2.7 LOW TEMPERATURE DETECTORS
A. Mounting: Twist-lock base interchangeable with smoke-detector bases.
B. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
C. Automatically adjusts its sensitivity by means of drift compensation and smoothing algorithms. The detector shall send trouble alarm if it is incapable of compensating for existing conditions.
D. Test button.

2.8 HEAT DETECTORS
A. General Requirements for Heat Detectors: Comply with UL 521.
   1. Temperature sensors shall test for and communicate the sensitivity range of the device.
B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
   1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
   2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.9 NOTIFICATION APPLIANCES
A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
B. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
   1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
C. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
   1. Rated Light Output:
      a. 15/30/75/110 cd, selectable in the field.
   2. Mounting: Wall mounted unless otherwise indicated.
   3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
   4. Flashing shall be in a temporal pattern, synchronized with other units.
   5. Strobe Leads: Factory connected to screw terminals.
D. Voice/Tone Notification Appliances:
   1. Comply with UL 1480.
   2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
   3. High-Range Units: Rated 2 to 15 W.
   4. Low-Range Units: Rated 1 to 2 W.
   5. Mounting: surface mounted and bidirectional.
   6. Matching Transformers: Tap range matched to acoustical environment of speaker location.

2.10 ADDRESSABLE INTERFACE DEVICE
A. General:
   1. Include address-setting means on the module.
   2. Store an internal identifying code for control panel use to identify the module type.
   3. Listed for controlling HVAC fan motor controllers.
B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.
C. Integral Relay: Capable of providing a direct signal to circuit-breaker shunt trip for power shutdown.
   1. Allow the control panel to switch the relay contacts on command.
   2. Have a minimum of two normally open and two normally closed contacts available for field wiring.
D. Control Module:
   1. Operate notification devices.
   2. Operate solenoids for use in sprinkler service.

2.11 RADIO ALARM TRANSMITTER
A. Transmitter shall comply with NFPA 1221 and 47 CFR 90.
B. Description: Manufacturer's standard commercial product; factory assembled, wired, and tested; ready for installation and operation.
   1. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
   2. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
   5. Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of
antenna and mounting hardware and supports shall withstand 100 mph (160 km/h) with a
gust factor of 1.3 without failure.
6. Antenna Cable: Coaxial cable with impedance matched to the transmitter output
   impedance.
8. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to
   the transmitter, matching fire-alarm and other system outputs to message-generating
   inputs of the transmitter that produce required message transmissions.

C. Functional Performance: Unit shall receive alarm, supervisory, or trouble signal from fire-alarm
   control unit or from its own internal sensors or controls and shall automatically transmit signal
   along with a unique code that identifies the transmitting station to the remote alarm receiving
   station. Transmitted messages shall correspond to standard designations for fire-reporting
   system to which the signal is being transmitted and shall include separately designated messages
   in response to the following events or conditions:
1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated
   value.
2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or
   automatically at an optionally preselected time, once every 24 hours, with transmission
   time controlled by a programmed timing device integral to transmitter controls.
3. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the
   transmitter normal power source, derangement of the wiring of the transmitter, or any alarm
   input interface circuit or device connected to it.
4. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a
   trouble signal to be indicated on the building system.
5. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an
   alarm state. Identifies device that initiated the alarm.
   system indicates a supervisory alarm.

2.12 DEVICE GUARDS
A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong,
   or other device requiring protection.
1. Factory fabricated and furnished by device manufacturer.
2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION
3.1 EXAMINATION
A. Examine areas and conditions for compliance with requirements for ventilation, temperature,
   humidity, and other conditions affecting performance of the Work.
1. Verify that manufacturer's written instructions for environmental conditions have been
   permanently established in spaces where equipment and wiring are installed, before
   installation begins.
B. Examine roughing-in for electrical connections to verify actual locations of connections before
   installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION
A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for
   installation and testing of fire-alarm equipment. Install all electrical wiring to comply with
   requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
1. Devices placed in service before all other trades have completed cleanup shall be
   replaced.
2. Devices installed but not yet placed in service shall be protected from construction dust,
   debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
B. Install wall-mounted equipment, with tops of cabinets not more than 78 inches (1980 mm) above
   the finished floor.
1. Comply with requirements for seismic-restraint devices specified in Section 26 0548.16
   "Seismic Controls for Electrical Systems."
C. Manual Fire-Alarm Boxes:
The Church of Jesus Christ of Latter Day Saints
Garden City Assembly Hall

1. Install manual fire-alarm box in the normal path of egress within 60 inches (1520 mm) of the exit doorway.
3. The operable part of manual fire-alarm box shall be between 42 inches (1060 mm) and 48 inches (1220 mm) above floor level. All devices shall be mounted at the same height unless otherwise indicated.

D. Smoke- or Heat-Detector Spacing:
1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. HVAC: Locate detectors not closer than 36 inches (910 mm) from air-supply diffuser or return-air opening.
4. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

E. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

F. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

G. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.

H. Device Location-Indicating Lights: Locate in public space near the device they monitor.
I. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that resists 100-mph (160-km/h) wind load with a gust factor of 1.3 without damage.

3.3 PATHWAYS
A. Pathways above recessed ceilings and in nonaccessible locations may be routed exposed.

1. Exposed pathways located less than 96 inches (2440 mm) above the floor shall be installed in EMT.
2. Pathways shall be installed in EMT.
3. Exposed EMT shall be painted red enamel.

3.4 CONNECTIONS
A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Supervisory connections at valve supervisory switches.
2. Supervisory connections at shunt-trip breaker.
3. Data communication circuits for connection to mass notification system.

3.5 IDENTIFICATION
A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.6 GROUNDING
A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.7 FIELD QUALITY CONTROL
A. Field tests shall be witnessed by authorities having jurisdiction.
B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
C. Perform tests and inspections.
D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
1. Visual Inspection: Conduct visual inspection prior to testing.
   a. Inspection shall be based on completed record Drawings and system documentation
      that is required by the "Completion Documents, Preparation" table in the
      "Documentation" section of the "Fundamentals" chapter in NFPA 72.
   b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of
      the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the
      "Initial/Reacceptance" column and list only the installed components.
2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the
   "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written
   instructions. Perform the test using a portable sound-level meter complying with Type 2
   requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written
   instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written
   instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of
   Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72
   and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing
   and Maintenance" chapter in NFPA 72.
E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or
   replaced devices and appliances.
F. Fire-alarm system will be considered defective if it does not pass tests and inspections.
G. Prepare test and inspection reports.
H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly,
   quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system
   complying with visual and testing inspection requirements in NFPA 72. Use forms developed for
   initial tests and inspections.

3.8 SOFTWARE SERVICE AGREEMENT
A. Comply with UL 864.
B. Technical Support: Beginning at Substantial Completion, service agreement shall include
   software support for two years.
C. Upgrade Service: At Substantial Completion, update software to latest version. Install and
   program software upgrades that become available within two years from date of Substantial
   Completion. Upgrading software shall include operating system and new or revised licenses for
   using software.
   1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to
      upgrade computer equipment if necessary.

3.9 DEMONSTRATION
A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION
DIVISION 31 -- EARTHWORK

31 2200 – EARTHWORK
SECTION 31 22 00
EARTHWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Suitable fill and backfill material requirements
B. Unsuitable material
C. Use of fill, backfill, and embankment material types
D. Materials testing

1.2 SUBMITTALS

A. CONTRACTOR shall submit material test results of all materials proposed to be used in the work in accordance with the requirements in Section 01 30 00 – “Submittal Procedure.” Sample sizes shall be as determined by the testing laboratory.

PART 2 - PRODUCTS

2.1 SUITABLE FILL AND BACKFILL MATERIAL REQUIREMENTS

A. General: Fill, backfill, and embankment materials shall be suitable selected or processed clean, fine earth, rock, or sand, free from grass, roots, brush, or other organic materials.

B. Fill and backfill materials to be placed within 6 inches of any structure or pipe shall be free of rocks or unbroken masses of earth materials having a maximum dimension larger than 3 inches.

C. Suitable Materials: Materials not defined as unsuitable below are defined as suitable materials and may be used in fills, backfilling, and embankment construction subject to the indicated limitations. In addition, when acceptable to ENGINEER, some of the material listed as unsuitable may be used when thoroughly mixed with suitable material to form a stable composite.

D. Suitable materials may be obtained from on-site excavations, may be processed on-site materials, or may be imported. If imported materials are required by this project or to meet the quantity requirements of the project CONTRACTOR shall provide the imported materials at no additional expense to OWNER, unless a unit price item is included for imported materials in the bidding schedule.

E. The following types of suitable materials are defined:

1. Type A (three-quarters inch minus granular backfill): Crushed rock or gravel, and sand with the gradation requirements below. The material shall have a minimum sand equivalent value of 28 and a minimum R-value of 78. If the sand equivalent value exceeds 35 the R-value requirement is waived.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4-inch</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>30 - 50</td>
</tr>
<tr>
<td>No. 200</td>
<td>0 – 12</td>
</tr>
</tbody>
</table>

2. Type B (Class I crushed stone): Manufactured angular, crushed stone, crushed rock, or crushed slag with the following gradation requirements. The material shall have a minimum sand equivalent value of 75.
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4-inch</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>30 - 50</td>
</tr>
<tr>
<td>No. 200</td>
<td>0 - 5</td>
</tr>
</tbody>
</table>

3. Type C (sand backfill): Sand with 100 percent passing a 3/8-inch sieve, at least 90 percent passing a Number 4 sieve, and a sand equivalent value not less than 30.

4. Type D: Not used

5. Type E (pea gravel backfill): Crushed rock or gravel with 100 percent passing a 3/8-inch sieve and not more than 10 percent passing a Number 4 sieve.

6. Type F (coarse drainrock): Crushed rock or gravel meeting the following gradation requirements:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-inch</td>
<td>100</td>
</tr>
<tr>
<td>1-1/2-inch</td>
<td>90 - 100</td>
</tr>
<tr>
<td>1-inch</td>
<td>20 - 55</td>
</tr>
<tr>
<td>3/4-inch</td>
<td>0 - 15</td>
</tr>
<tr>
<td>No. 200</td>
<td>0 – 3</td>
</tr>
</tbody>
</table>

7. Type G (untreated base course): Aggregate Base Course:
   a. Consist of hard, durable particles of fragments of stone or gravel, screened or crushed to required size and grading and free from vegetable matter, lumps or balls of clay, alkali, adobe, or other deleterious matter.
   b. Materials derived from processing demolished or removed asphalt concrete are not acceptable.
   c. When sampled and tested in accordance with specified test methods, material shall comply with following requirements:
      1) Percentage of Wear: Not exceed 50 percent after 500 revolutions when tested in accordance with ASTM C 131.
      2) Plasticity Index: Not be more than 5 when tested in accordance with ASTM D 4318.
      3) Liquid Limit: Not be more than 25 percent when tested in accordance with ASTM D 4318.
   d. Aggregate Base Course for Structures:
   e. Consist of crushed or fragmented particles.
   f. Grade within the following limits when tested in accordance with ASTM C 136 and ASTM C 117:

<table>
<thead>
<tr>
<th>Sieve Sizes (Square Openings)</th>
<th>Percent by Weight Passing Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/2 inch</td>
<td>100</td>
</tr>
<tr>
<td>% inch</td>
<td>81-91</td>
</tr>
<tr>
<td>% inch</td>
<td>67-77</td>
</tr>
<tr>
<td>Number 4</td>
<td>43-53</td>
</tr>
<tr>
<td>Number 16</td>
<td>23-29</td>
</tr>
<tr>
<td>Number 200</td>
<td>6-10</td>
</tr>
</tbody>
</table>

8. Type H (graded drainrock): Drainrock shall be crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting or drying. The material shall be uniformly graded and shall meet the following gradation requirements:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-inch</td>
<td>100</td>
</tr>
<tr>
<td>%4-inch</td>
<td>90 - 100</td>
</tr>
<tr>
<td>3/8-inch</td>
<td>40 – 100</td>
</tr>
<tr>
<td>No. 4</td>
<td>25 – 40</td>
</tr>
</tbody>
</table>
The drainrock shall have a sand equivalent value not less than 75. The finish graded surface of the drainrock immediately beneath hydraulic structures shall be stabilized to provide a firm, smooth surface upon which to construct reinforced concrete floor slabs.

9. **Type I**: Any other suitable material as defined herein.

10. **Type J (cement-treated backfill)**: Material which consists of Type H material, or any mixture of Types B, C, G, and H materials which has been cement-treated so that the cement content of the material is not less than 5 percent by weight when tested in accordance with ASTM D 2901 - Standard Test Method for Cement Content of Freshly Mixed Soil Cement. The ultimate compressive strength at 28 days shall be not less than 400 psi when tested in accordance with ASTM D 1633 - Standard Test Method for Compressive Strength of Molded Soil - Cement Cylinders.

11. **Type K (topsoil)**: Stockpiled topsoil material which has been obtained at the site by removing soil to a depth not exceeding 1 foot. Removal of the topsoil shall be done after the area has been stripped of vegetation and debris.

12. **Type L (not used)**

13. **Type M (aggregate subbase)**: Screened of crushed rock aggregate subbase material that can be compacted readily by watering and rolling to form a firm stable base. The following sand equivalent value shall be not less than 18 and the material shall meet the following gradation requirements:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-inch</td>
<td>100</td>
</tr>
<tr>
<td>2-inch</td>
<td>90-100</td>
</tr>
<tr>
<td>1-inch</td>
<td>55-83</td>
</tr>
<tr>
<td>No. 4</td>
<td>30-60</td>
</tr>
<tr>
<td>No. 30</td>
<td>10-25</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-8</td>
</tr>
</tbody>
</table>

14. **Type N (trench plug)**: Low permeable fill material, a non-dispersible clay material having a minimum plasticity index of 10.

### 2.2 UNSUITABLE MATERIAL

A. Unsuitable materials include the materials listed below.

1. Soils which, when classified under ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System), fall in the classifications of Pt, OH, CH, MH, or OL.

2. Soils which cannot be compacted sufficiently to achieve the density specified for the intended use.

3. Materials that contain hazardous or designated waste materials including petroleum hydrocarbons, pesticides, heavy metals, and any material which may be classified as hazardous or toxic according to applicable regulations.

4. Topsoil, except as allowed below.

### 2.3 USE OF FILL, BACKFILL, AND EMBANKMENT MATERIAL TYPES

A. CONTRACTOR shall use the types of materials as indicated in the Drawings and as noted in the project Geotechnical Report or as a preapproved equal (must be in writing) by the ENGINEER. If no type designation is specified in the Drawings, CONTRACTOR shall use the types of materials herein for all required fill, backfill, and embankment construction hereunder.
B. Where these Specifications conflict with the requirements of any local agency having jurisdiction or with the requirements of a pipe material manufacturer, ENGINEER shall be immediately notified. In case of conflict between types of pipe embedment backfills, CONTRACTOR shall use the agency-specified backfill material if that material provides a greater degree of structural support to the pipe, as determined by ENGINEER. In case of conflict between types of trench or final backfill types, CONTRACTOR shall use the agency-specified backfill material if that material provides the greater in-place density after compaction.

C. Fill and backfill types shall be used in accordance with the following provisions:

1. Embankment fills shall be constructed of Type I material, as defined herein, or any mixture of Type I and Type A through Type H materials.
2. Pipe zone backfill, as defined under "Pipe and Utility Trench Backfill" below, shall consist of the following materials for each pipe material listed below.
   a. Mortar coated pipe, concrete pipe, and un-coated ductile iron pipe shall be provided Type A or C pipe bedding and embedment backfill material.
   b. Coal tar enamel coated pipe, polyethylene encased pipe, tape wrapped pipe, and other non-mortar coated pipe shall be backfilled with Type C bedding and embedment zone backfill material.
   c. Plastic pipe and vitrified clay pipe shall be backfilled with Type C bedding and embedment zone backfill material.
   d. Where pipelines are installed on grades exceeding 4 percent, and where backfill materials are graded such that there is less than 10 percent passing a Number 4 sieve, trench plugs of Type J, L, or N material shall be provided at maximum intervals of 200 feet unless indicated otherwise.
3. Trench zone backfill for pipelines as defined under "Pipe and Utility Trench Backfill" shall be Type I backfill material or any of Types A through H backfill materials or any mixture thereof, except:
   a. Type K material may be used for trench zone backfill in agricultural areas unless otherwise shown or specified.
4. Final backfill material for pipelines under paved areas, as defined under "Pipe and Utility Trench Backfill" shall be Type G backfill material. Final backfill under areas not paved shall be the same material as that used for trench backfill, except that Type K material shall be used for final backfill in agricultural areas unless otherwise indicated.
5. Trench backfill and final backfill for pipelines under structures shall be the same material as used in the pipe zone, except where concrete encasement is required by the Contract Documents.
6. Aggregate base materials under pavements shall be Type G material constructed to the thicknesses indicated. Aggregate subbase shall be Type M material.
7. Backfill around structures shall be Type I material, or Types A through Type H materials, or any mixture thereof, except as shown.
8. Backfill materials beneath structures shall be as follows:
   a. Drainrock materials under hydraulic structures or other water retaining structures with underdrain systems shall be Type H material.
   b. Under concrete hydraulic structures or other water retaining structures without underdrain systems, Types M materials shall be used.
   c. Under structures where groundwater must be removed to allow placement of concrete, Type M material shall be used. Before the Type M material is placed, filter fabric shall be placed over the exposed foundation.
   d. Under all other structures, Type M material shall be used.
9. Backfill used to replace pipeline trench over-excavation shall be a layer of Type F material with a 6-inch top filter layer of Type E material or filter fabric to prevent migration of fines for wet trench conditions or the same material as used for the pipe zone backfill if the trench conditions are not wet.
10. The top 6 inches of fill on reservoir roofs, embankment fills around hydraulic structures, and all other embankment fills shall consist of Type K material, topsoil.
11. Filter fabric shall be non-woven geotextile. Use Mirafi 140 N, Amoco 1199, or equal fabric meeting the following requirements:
   a. Mullen Burst Strength (ASTM D3786) 250 psi minimum
   b. Grab Tensile Strength (ASTM D4632) 180 lbs minimum
   c. Apparent Opening Size (ASTM D4751) 70 to 120 sieve
   d. Flow Rate (ASTM D4491) 4 gal/min/sq. ft minimum

2.4 MATERIALS TESTING

   A. All soils testing of samples submitted by CONTRACTOR will be done by a testing laboratory of OWNER’S choice and at CONTRACTOR’S expense. At its discretion, ENGINEER may request that CONTRACTOR supply samples for testing of any material used in the work.

   B. Particle size analysis of soils and aggregates will be performed using ASTM D 422 - Standard Test Method for Particle-Size Analysis of Soils.

   C. Determination of sand equivalent value will be performed using ASTM D 2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

   D. Unified Soil Classification System: References in this Section to soil classification types and standards shall have the meanings and definitions indicated in ASTM D 2487. CONTRACTOR shall be bound by all applicable provisions of said ASTM D 2487 in the interpretation of soil classifications.

PART 3 - EXECUTION

3.1 EXCAVATION - GENERAL

   A. General: Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the WORK. The removal of said materials shall conform to the lines and grades indicated or ordered. Unless otherwise indicated, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. CONTRACTOR shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable State safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926). Work shall be completed in accordance with the project Geotechnical Report.

   B. Removal and Exclusion of Water: CONTRACTOR shall remove and exclude water, including stormwater, groundwater, irrigation water, and wastewater, from all excavations. Dewatering wells, wellpoints, sump pumps, or other means shall be used to remove water and continuously maintain groundwater at a level at least two feet below the bottom of excavations before the excavation work begins at each location. Water shall be removed and excluded until backfilling is complete and all field soils testing has been completed and conditions allowing dewatering to cease are met. CONTRACTOR shall maintain a contingency plan to rapidly remove water that may infiltrate the base of excavations.

   C. Frozen Subgrade and Foundation Materials: CONTRACTOR shall protect the subgrade and foundation materials from freezing. Subgrade soils or structural fill that is allowed to freeze will be thawed and re-compacted to structural fill requirements by CONTRACTOR at no cost to OWNER. Do not place concrete or structural fill over frozen soil.
3.2 STRUCTURE, ROADWAY, AND EMBANKMENT EXCAVATION

A. Excavation Beneath Structures and Embankments: Except where otherwise indicated for a particular structure or ordered by ENGINEER, excavation shall be carried to the grade of the bottom of the footing or slab. Where indicated or ordered, areas beneath structures or fills shall be over-excavated. The subgrade areas beneath embankments shall be excavated to remove not less than the top 6 inches of native material and where such subgrade is sloped, the native material shall be benched. When such over-excavation is indicated, both over-excavation and subsequent backfill to the required grade shall be performed by CONTRACTOR. When such over-excavation is not indicated but is ordered by ENGINEER, such over-excavation and any resulting backfill will be paid for under a separate unit price bid item if such bid item has been established; otherwise payment will be made in accordance with a negotiated price. After the required excavation or over-excavation has been completed, the exposed surface shall be scarified to a depth of 6 inches, brought to optimum moisture content, and rolled with heavy compaction equipment to obtain 95 percent of maximum density, as determined by ASTM D 1557.

B. Excavation Beneath Paved Areas: Excavation under areas to be paved shall extend to the bottom of the aggregate base or subbase, if such base is called for; otherwise it shall extend to the paving thickness. After the required excavation has been completed, the top 12 inches of exposed surface shall be scarified, brought to optimum moisture content, and rolled with heavy compaction equipment to obtain 95 percent of maximum density as determined by ASTM D 1557. The finished subgrade shall be even, self-draining, and in conformance with the slope of the finished pavement. Areas that could accumulate standing water shall be re-graded to provide a self-draining subgrade.

C. Notification of ENGINEER: CONTRACTOR shall notify ENGINEER at least 3 days in advance of completion of any structure excavation and shall allow ENGINEER a review period of at least one day before the exposed foundation is scarified and compacted or is covered with backfill or with any construction materials.

3.3 PIPELINE AND UTILITY TRENCH EXCAVATION

A. Exploratory Excavation
1. CONTRACTOR shall excavate and expose buried points of connection to existing utilities where indicated on the Drawings. Excavation shall be performed prior to preparation of Shop Drawings for connections and before fabrication of pipe, and the data obtained shall be used in preparing Shop Drawings.
2. Data, including dates, locations excavated, and sketches, shall be submitted to ENGINEER within one week of excavation.
3. Damage to utilities from excavation activities shall be repaired by CONTRACTOR.

B. General: Unless otherwise indicated or ordered, excavation for pipelines and utilities shall be open-cut trenches with widths as indicated.

C. Trench Bottom: Except when pipe bedding is required, the bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe bedding. Excavations for pipe bells and welding shall be made as required.
D. Open Trench: The maximum amount of open trench permitted in any one location shall be 500 feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater. All trenches shall be fully backfilled at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day. The above requirements for backfilling or use of steel plate will be waived in cases where the trench is located further than 100 feet from any traveled roadway or occupied structure. In such cases, however, barricades and warning lights meeting safety requirements shall be provided and maintained.

E. Trench Over-Excavation: Where trenches are indicated to be over-excavated, excavation shall be to the depth indicated, and backfill shall be installed to the grade of the bottom of the pipe bedding.

F. Over-Excavation: When ordered by ENGINEER, whether indicated on the Drawings or not, trenches shall be over-excavated beyond the depth and/or width shown. Such over-excavation shall be to the dimensions ordered. The trench shall then be backfilled to the grade of the bottom of the pipe bedding. Over-excavation less than 6 inches below the limits on the Drawings shall be done at no increase in cost to OWNER. When the over-excavation ordered by ENGINEER is 6 inches or greater below the limits shown, or wider, additional payment will be made to CONTRACTOR. Said additional payment will be made under separate unit price bid items for over-excavation if such bid items have been established; otherwise payment will be made in accordance with a negotiated price.

G. Where pipelines are to be installed in embankments, fills, or structure backfills, the fill shall be constructed to a level at least one foot above the top of the pipe before the trench is excavated.

H. If a moveable trench shield is used during excavation operations, the trench width shall be wider than the shield so that the shield is free to be lifted and then moved horizontally without binding against the trench sidewalls. If the trench walls cave in or slough, the trench shall be excavated as an open excavation with sloped sidewalls or with trench shoring, as indicated and as required by the pipe structural design.

3.4 OVER-EXCAVATION NOT ORDERED OR INDICATED

A. Any over-excavation carried below the grade ordered or indicated, shall be backfilled and compacted to the required grade with the indicated material.

3.5 EXCAVATION IN LAWN AREAS

A. Where excavation occurs in lawn areas, the sod shall be carefully removed, dampened, and stockpiled to preserve it for replacement. Excavated material may be placed on the lawn; provided, that a drop cloth or other suitable method is employed to protect the lawn from damage. The lawn shall not remain covered for more than 72 hours. Immediately after completion of backfilling, the sod shall be replaced and lightly rolled in a manner so as to restore the lawn as near as possible to its original condition. CONTRACTOR shall provide new sod if stockpiled sod has not been replaced within 72 hours.

3.6 EXCAVATION IN VICINITY OF TREES

A. Except where trees are indicated to be removed, trees shall be protected from injury during construction operations. No tree roots over 2 inches in diameter shall be cut without express permission of ENGINEER. Trees shall be supported during excavation by any means previously reviewed by ENGINEER.

3.7 ROCK EXCAVATION
A. Rock excavation shall include removal and disposal of the following: (1) all boulders measuring 1/3 of a cubic yard or more in volume; (2) all rock material in ledges, bedding deposits, and un-stratified masses which cannot be removed without systematic drilling and blasting; (3) concrete or masonry structures which have been abandoned; and (4) conglomerate deposits which are so firmly cemented that they possess the characteristics of solid rock and which cannot be removed without systematic drilling and blasting.

B. Rock excavation shall be performed by CONTRACTOR; provided, that should the quantity of rock excavation be affected by any change in the scope of the work, an appropriate adjustment of the contract price will be made under a separate bid item if such bid item has been established; otherwise payment will be made in accordance with a negotiated price.

C. Explosives and Blasting
   1. Blasting will not be permitted.

3.8 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. CONTRACTOR shall remove and dispose of all excess excavated material at a site selected by CONTRACTOR and reviewed by ENGINEER.

B. CONTRACTOR shall obtain all required permits, landowner, and agency approvals for disposal of excess excavated material and shall pay all costs associated with the removal and disposal.

3.9 BACKFILL - GENERAL

A. Backfill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around or upon any structure until the concrete has attained sufficient strength to withstand the loads imposed. Backfill around water retaining structures shall not be placed until the structures have been tested, and the structures shall be full of water while backfill is being placed.

B. Except for drainrock materials being placed in over-excavated areas or trenches, backfill shall be placed after all water is removed from the excavation, and the trench sidewalls and bottom have been dried to a moisture content suitable for compaction.

C. If a moveable trench shield is used during excavation, pipe installation, and backfill operations, the shield shall be moved by lifting the shield free of the trench bottom or backfill and then moving the shield horizontally, CONTRACTOR shall not drag trench shields along the trench causing damage or displacement to the trench sidewalls, the pipe, or the bedding and backfill.

D. Immediately prior to placement of backfill materials, the bottoms and sidewalls of trenches and structure excavations shall have all loose sloughing, or caving soil and rock materials removed. Trench sidewalls shall consist of excavated surfaces that are in a relatively undisturbed condition before placement of backfill materials.

3.10 PLACING AND SPreading OF BACKFILL MATERIALS

A. Backfill materials shall be placed and spread evenly in layers. When compaction is achieved using mechanical equipment, the layers shall be evenly spread so that when compacted, each layer shall not exceed 6 inches in thickness.

B. During spreading, each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer. Pipe zone backfill materials shall be manually spread around the pipe so that when compacted, the pipe zone backfill will provide uniform bearing and side support.
C. Where the backfill material moisture content is below the optimum moisture content, water shall be added before or during spreading until the proper moisture content is achieved.

D. Where the backfill material moisture content is too high to permit the specified degree of compaction the material shall be dried until the moisture content is satisfactory.

3.11 COMPACTION OF FILL, BACKFILL, AND EMBANKMENT MATERIALS

A. Each layer of Types A, B, C, G, H, I, and K backfill materials as defined herein, where the material is graded such that at least 10 percent passes a No. 4 sieve, shall be mechanically compacted to the indicated percentage of density. Equipment that is consistently capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content.

B. Each layer of Type E, F, and J backfill materials shall be compacted by means of at least 2 passes from a flat plate vibratory compactor. When such materials are used for pipe zone backfill, vibratory compaction shall be used at the top of the pipe zone or at vertical intervals of 24 inches, whichever is the least distance from the subgrade.

C. Fill on reservoir and structure roofs shall be deposited at least 30 days after the concrete roof slab has been placed. Equipment weighing more than 10,000 pounds when loaded shall not be used on a roof. A roller weighing not more than 8,000 pounds shall be used to compact fill on a roof.

D. Flooding, ponding, or jetting shall not be used for fill on roofs, backfill around structures, backfill around reservoir walls, for final backfill materials, or aggregate base materials.

E. Equipment weighing more than 10,000 pounds shall not be used closer to walls than a horizontal distance equal to the depth of the fill at that time. Hand operated power compaction equipment shall be used where use of heavier equipment is impractical or restricted due to weight limitations.

F. Backfill around and over pipelines that is mechanically compacted shall be compacted using light, hand operated, vibratory compactors and rollers. After completion of at least two feet of compacted backfill over the top of pipeline, compaction equipment weighing no more than 8,000 pounds may be used to complete the trench backfill.

G. Compaction Requirements: The following compaction test requirements shall be in accordance with ASTM D 1557 - Test Method for Laboratory Compaction Characteristics of Soils Using Modified Proctor (56,000 ft-lb/ft$^3$) (2,700 kN-m/m$^3$) for all soil types. Where agency or utility company requirements govern, the highest compaction standards shall apply.

<table>
<thead>
<tr>
<th>Location or Use of Fill</th>
<th>Percentage of Maximum Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe embedment backfill for flexible pipe.</td>
<td>95</td>
</tr>
<tr>
<td>Pipe bedding and over-excavated zones under bedding for flexible pipe, including trench plugs.</td>
<td>95</td>
</tr>
<tr>
<td>Pipe embedment backfill for rigid pipe</td>
<td>90</td>
</tr>
<tr>
<td>Pipe zone backfill portion above embedment for rigid pipe.</td>
<td>95</td>
</tr>
<tr>
<td>Pipe bedding and over-excavated</td>
<td></td>
</tr>
</tbody>
</table>
zones under bedding for rigid pipe. 95

Final backfill, beneath paved areas or structures. 95

Final backfill, not beneath paved areas or structures. 90

Trench zone backfill, beneath paved areas and structures, including trench plugs. 95

Trench zone backfill, not beneath paved areas or structures, including trench plugs. 90

Embankments and fills. 92

Embankments and fills beneath paved areas or structures. 95

Backfill beneath structures and hydraulic structures. 95

Backfill and fill around structures on reservoir or structure roof. 92

Topsoil (Type K material) 80

Aggregate base or subbase
(Type G or M material) 95

3.12 PIPE AND UTILITY TRENCH BACKFILL

A. Pipe Zone Backfill
   1. The pipe zone is defined as that portion of the vertical trench cross-section lying between a plane below the bottom surface of the pipe and a plane at a point above the top surface of the pipe as indicated. The bedding is defined as that portion of pipe zone backfill material between the trench subgrade and the bottom of the pipe. The embedment is defined as that portion of the pipe zone backfill material between the bedding and a level line as indicated.
   2. After compacting the bedding CONTRACTOR shall perform a final trim using a stringline for establishing grade, such that each pipe section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe. Excavation for pipe bells and welding shall be made as required.
   3. The pipe zone shall be backfilled with the indicated backfill material. CONTRACTOR shall exercise care to prevent damage to the pipeline coating and the pipe itself during the installation and backfill operations.
   4. If a moveable trench shield is used during backfill operations the shield shall be lifted to a location above each layer of backfill material prior to compaction of the layer. CONTRACTOR shall not displace the pipe or backfill while the shield is being moved.

B. Trench Zone Backfill: After the pipe zone backfills have been placed, backfilling of the trench zone may proceed. The trench zone is defined as that portion of the vertical trench cross-section lying as indicated between a plane above the top surface of the pipe and a plane at a point 18 inches below the finished surface grade, or if the trench is under pavement, 18 inches below the roadway subgrade.
C. Final Backfill: Final backfill is all backfill in the trench cross-sectional area within 18 inches of finished grade, or if the trench is under pavement, all backfill within 18 inches of the roadway subgrade.

3.13 FILL AND EMBANKMENT CONSTRUCTION

A. The area where a fill or embankment is to be constructed shall be cleared of all vegetation, roots and foreign material. Following this, the surface shall be moistened, scarified to a depth of 6 inches, and rolled or otherwise mechanically compacted. Embankment and fill material shall be placed and spread evenly in approximately horizontal layers. Each layer shall be moistened or aerated, as necessary. Unless otherwise approved by ENGINEER, each layer shall not exceed 6 inches of compacted thickness. The embankment, fill, and the scarified layer of underlying ground shall be compacted to 95 percent of maximum density under structures and paved areas, and 90 percent of maximum density elsewhere.

B. When an embankment or fill is to be made and compacted against hillsides or fill slopes steeper than 4:1, the slopes of hillsides or fills shall be horizontally benched to key the embankment or fill to the underlying ground. A minimum of 12 inches normal to the slope of the hillside or fill shall be removed and re-compacted as the embankment or fill is brought up in layers. Material thus cut shall be re-compacted along with the new material. Hillside or fill slopes 4:1 or flatter shall be prepared in accordance with Paragraph A, above.

C. Where embankment or structure fills are constructed over pipelines, the first 4 feet of fill over the pipe shall be constructed using light placement and compaction equipment that does not damage the pipe. Heavy construction equipment shall maintain a minimum distance from the edge of the trench equal to the depth of the trench until at least 4 feet of fill over the pipe has been completed.

3.14 FIELD TESTING

A. General: All field soils testing will be done by a testing laboratory of OWNER's choice at OWNER's expense except as indicated below.

B. Where soil material is required to be compacted to a percentage of maximum density, the maximum density at optimum moisture content will be determined in accordance with Method C of ASTM D 1557. Field density in-place tests will be performed in accordance with ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method, ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place By Nuclear Methods (Shallow Depth), or by such other means acceptable to ENGINEER.

C. In case the test of the fill or backfill show non-compliance with the required density, CONTRACTOR shall accomplish such remedy as may be required to insure compliance. Subsequent testing to show compliance shall be by a testing laboratory selected by OWNER and paid by CONTRACTOR.

D. CONTRACTOR shall provide test trenches and excavations including excavation, trench support, and groundwater removal for OWNER'S field soils testing operations. The trenches and excavations shall be provided at the locations and to the depths required by OWNER.
DIVISION 32 -- EXTERIOR IMPROVEMENTS

32 1216 – Asphalt Concrete Paving
32 3113 – Chain Link Fences and Gates
SECTION 32 12 16
ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pit run
B. Untreated base course materials
C. Asphalt pavement materials
D. Asphalt pavement mix

1.2 REFERENCES


1.3 INSPECTION AND TESTING

A. Testing and inspection will be performed so as to minimize disruption to Work.

B. Allow testing laboratory access to the mixing plant for verification of weights or proportions, character of materials used and determination of temperatures used in the preparation of asphaltic concrete mix.

C. When and if required, the testing laboratory will perform laboratory tests on proposed asphaltic pavement mix(es) to determine conformity with requirements.

D. The testing laboratory will perform one (1) series of compaction tests per 100 square yards for untreated base course and one (1) series of compaction tests per 100 square yards for each lift of asphalt surface course.

E. When untreated base course or portion thereof has been placed and compacted in accordance with requirements, notify the testing laboratory to perform density tests. Do not place asphalt surface courses until results have been verified and base course installation approved.

F. If compaction tests indicate that untreated base course or asphalt surface course do not meet specified requirements, remove defective work, replace and retest at own expense. Core testing may be required by ENGINEER to evaluate defective work.

1.4 SUBMITTALS

A. Certified sieve analysis of untreated base course material and samples of this material for determination of Proctor values.

B. Certified sieve analysis of aggregate materials for asphalt pavement.

C. Proposed asphalt pavement mix with Marshall Test results for the proposed mix.
D. Seven (7) days prior to delivery of any bituminous paving to the job site, CONTRACTOR shall submit the proposed job mix to ENGINEER for approval. The job mix shall be submitted by CONTRACTOR, and no bituminous mixture shall be manufactured until it has been approved. Data shall be provided that show the proposed mix will produce a mixture which meets the requirements of these Specifications and the specific Marshall Test results, including density voids analysis and stability flow tests. Previously established test results will be accepted provided the tests were performed within the last six months.

PART 2 - PRODUCTS

2.1 PIT RUN

A. Pit run shall be well-graded, non-expansive granular sand and gravel material imported from off-site with a maximum size of 2 inches and no greater than 15 percent passing the No. 200 sieve.

2.2 UNTREATED BASE COURSE MATERIALS

A. Granular Base: Angular crushed natural stone; free from shale, organic matter and debris; graded within following limits:

<table>
<thead>
<tr>
<th>1&quot; GRADATION</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inch</td>
<td>100</td>
</tr>
<tr>
<td>½-inch</td>
<td>79 to 91</td>
</tr>
<tr>
<td>No. 4</td>
<td>49 to 61</td>
</tr>
<tr>
<td>No. 16</td>
<td>27 to 35</td>
</tr>
<tr>
<td>No. 50</td>
<td>17 to 21</td>
</tr>
<tr>
<td>No. 200</td>
<td>5 to 12</td>
</tr>
</tbody>
</table>

B. Primer: Homogeneous medium curing liquid asphalt; of type recommended for asphaltic paving; of grade to suit job conditions.

C. Tack Coat: Emulsified asphalt (AC-10) to be used as the tack coat shall meet the requirements of ASTM D977-80, Grade SS-1h or ASTM D2397-79 Grade CSS-1h.

2.3 ASPHALT PAVEMENT MATERIALS

A. Mineral Aggregate: Mineral aggregate shall consist of crushed stone, crushed gravel, or crushed slag conforming to the following requirements:

1. Coarse aggregate, retained on the No. 4 sieve, shall consist of clean, hard, tough, durable and sound fragments, and shall be free from organic matter or other deleterious substances.

2. That portion of the aggregate retained on the No. 4 sieve shall have not less than 50% of particles by weight with at least one mechanically fractured face or clean angular face.

3. Fine aggregate passing the No. 4 sieve may be either a natural or manufactured product. The aggregate shall be clean, hard grained and moderately sharp, and shall contain not vegetable matter or other deleterious substances.

4. That portion of the fine aggregate passing the No. 40 sieve shall be non-plastic when tested in accordance with AASHTO Designation T-90.
5. The weight of minus 200 mesh material retained in the aggregate, as determined by the difference in percent passing a No. 200 sieve by washing and dry sieving without washing, shall not exceed 6% of the total sample weight. The portion of fine aggregate passing the No. 200 sieve shall be determined by washing with water in accordance with AASHTO Designation T-11.

6. The aggregate shall be of uniform density and quality and shall have a rodded weight of not less than 75 lbs/cu. ft. when tested in accordance with AASHTO Designation T-19.

7. The aggregate shall have a percentage of wear not exceeding 40 when tested in accordance with AASHTO Designation T-96.

B. Asphalt Cement: Homogeneous; free of water; will not foam when heated to 177°C; 85/100 penetration grade; shall meet requirements of ASTM D3381; viscosity AC 10 for moderate climates.

C. Seal Coat: Fog type as defined in Manual No. 4; The Asphalt Institute (MS-4).

2.4 ASPHALT PAVEMENT MIX

A. Combine mineral constituents in proportions to produce a mixture conforming to following gradation requirements:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage by Weight (Percent Passing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inch</td>
<td>100</td>
</tr>
<tr>
<td>½-inch</td>
<td>73-93</td>
</tr>
<tr>
<td>No. 4</td>
<td>46-62</td>
</tr>
<tr>
<td>No. 16</td>
<td>22-34</td>
</tr>
<tr>
<td>No. 50</td>
<td>11-23</td>
</tr>
<tr>
<td>No. 200</td>
<td>3-9 (non-plastic)</td>
</tr>
</tbody>
</table>

B. Percentage by weight of asphalt cement in mixture: 5.0% to 7.0% for surface course.

C. Maintain thorough and uniform mixture.

D. Bring asphalt cement and mineral constituents to required temperatures before mixing. Ensure aggregates are sufficiently dry so as not to cause foaming in mixture.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure grading of sub-grade to required elevation.

B. Scarify sub-grade, where asphalt pavement is to be placed, to a depth of minimum 8 inches. Windrow loosened soil to one side.

C. Where existing gravel has been windrowed and retained for sub-grade, incorporate such into the top 8 inches by mixing and blading. Compact as specified for sub-grade in Section 31 22 00 – “Earthwork.”
D. Water and thoroughly mix sub-grade until optimum moisture content is obtained when deficiency of moisture content exists. When excess of moisture exists, rework and aerate sub-grade until optimum moisture content is obtained.

E. Before final rolling, shape entire section, add additional sub-soil as required and compact sub-grade to provide grades, elevation and cross-section indicated. Points of finished sub-grade surface shall be within 1 inch of elevations indicated.

3.2 PLACEMENT OF PIT RUN AND UNTREATED BASE COURSE

A. Bring pit run course to required depth(s) and profiles indicated. Extend pit run a minimum 6 inches beyond asphalt pavement width. Place in layers not exceeding 4 inches in depth. Compact each layer to 95% maximum dry density. Properly compact areas adjacent to curbs, catch basins, manholes and other areas not accessible to rollers with mechanical or hand tamping devices. Ensure granular pit run material is not contaminated with deleterious materials.

B. Add water during compaction to bring granular material to optimum moisture content.

C. Spread base course materials over prepared pit run to a minimum compacted depth as indicated on the drawings. Compact to 95% maximum dry density. Ensure top surface of base course is true to lines and grades indicated, with all points within ½ inch of elevations indicated.

D. Add water during compaction to bring stabilizing base course materials to optimum moisture content. When an excess moisture exists, rework stabilizing base course materials until optimum moisture content is obtained.

3.3 PRIMING PREPARED UNTREATED BASE COURSE

A. Ensure untreated base course is dry and free of loose or foreign material before priming. Priming is not required for asphalt pavement areas to be repaired. A tack coat shall be provided.

B. Apply primer over prepared, untreated base course at a uniform rate of 0.03 gallon per sq. yd. Ensure primer is at temperature recommended by manufacturer. Use clean natural sand to blot excess primer.

C. Tack and/or prime surfaces of manholes, catch basins, valves, curbs, gutters, waterways, and other appurtenances which will be in contact with asphalt pavement.

D. Coat surfaces of manholes and catch basins which are to remain free of asphalt with oil to prevent asphalt adhesion.

3.4 PLACEMENT OF ASPHALT PAVEMENT

A. Place asphalt pavement surface course within 12 hours of priming untreated base course.

B. Place asphalt pavement to compacted depth indicated on the drawings. The maximum compacted depth of each lift of asphalt surface course shall not exceed 3-inch thickness.

C. Do not place asphalt pavement when surface temperature is 40°C or lower; or during rainy weather; or when the subgrade, sub-base, or base course is wet or frozen; or during other unfavorable weather conditions as determined by ENGINEER. Ensure asphalt pavement is minimum 118°C immediately after placing and prior to initial rolling.
D. Offset longitudinal joints in succeeding course at least six (6) inches traversely to avoid a vertical joint through more than one course.

E. Compact asphalt paving surface course to required density, with approved rolling equipment. Start compaction as soon as pavement will bear equipment without checking or undue displacement.

F. Carry out compaction in three operations in pass sequence. Ensure each pass of roller overlaps previous passes to ensure smooth surface free of roller marks. Keep roller wheels sufficiently moist so as not to pick up material.

G. Perform hand tamping in areas not accessible to rolling equipment.

H. Ensure joints made during paving operations are straight, clean, vertical and free of broken or loose material. Prime vertical surfaces of joints to ensure tight bond.

I. Ensure surface of completed asphalt pavement is true to lines, profiles and elevations indicated, and is free from depressions exceeding ¼ inch when measured with a 10 ft. straightedge.

J. Do not allow vehicular traffic on newly paved areas until surface has cooled to atmospheric temperature.

3.5 SEAL COAT

A. Apply seal coat in accordance with requirements of Asphalt Institute Manual No. 13, (MS-13).

3.6 ADJUSTING MANHOLE FRAMES AND VALVES

A. Adjust manholes, valves, and other appurtenances to required elevations.

B. Provide asphalt collars when adjustments are required.

C. Adjustment of manholes, valves, and other appurtenances are considered incidental to the Work and no additional payment will be made for adjustments or paving repairs.

END OF SECTION
SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Concrete
B. Posts, caps, rails, couplings
C. Chain link fabric
D. Barbed wire
E. Tension wires and fabric ties
F. Truss or tension bars
G. Fittings and hardware
H. Support or extension arm
I. Gates
J. Gate hardware

1.2 RELATED SECTIONS

A. Section 03 30 00 – “Cast-In-Place Concrete”

1.3 REFERENCES

A. ANSI/ASTM A 123 - Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
B. ANSI/ASTM F 567 - Installation of Chain-Link Fence
C. ASTM A 116 - Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric
D. ASTM A 120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized) Welded and Seamless, for Ordinary Uses
E. ASTM A 121 - Zinc-Coated (Galvanized) Steel Barbed Wire
F. ASTM A 153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware
G. ASTM A 392 - Zinc-Coated Steel Chain-Link Fence Fabric
H. ASTM A 428 - Weight of Coating on Aluminum-Coated Iron or Steel Articles
I. ASTM A 569 - Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip Commercial Quality
J. ASTM C 94 - Ready-mixed Concrete
K. Chain Link Fence Manufacturers Institute (CLFMI) - Product Manual
L. FS RR-F-191 - Fencing, Wire and Post Metal (and Gates, Chain Link Fence Fabric, and Accessories)

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 – “Submittal Procedure.”
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.

C. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.

D. Samples: Submit two samples of fence fabric, 12x12 inch in size illustrating construction and finish.

E. Manufacturer's Installation Instructions: Indicate installation requirements, post foundation, and anchor bolt templates.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01 30 00 – “Submittal Procedure.”

B. Accurately record actual locations of property perimeter posts relative to project boundary.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ANSI/ASTM F567.

B. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years experience.

PART 2 - PRODUCTS

2.1 GENERAL

A. Steel: ASTM A 53.

B. Pipe: Schedule 40 steel.

2.2 CONCRETE

A. Class 3000 minimum, in accordance with Section 03 30 00 – “Cast-In-Place Concrete.”

2.3 POSTS, CAPS, RAILS, COUPLINGS

A. Posts: Galvanized steel, at the indicated length.

B. Caps: Pressed galvanized steel or malleable iron designed to fit securely over post ends forming a weather tight closure. Where top rail is used, provide cap to permit passage of top rail. "H" section posts do not require caps.

C. Top, Intermediate and Bottom Rails: Galvanized steel, in lengths as required. Provide joint coupling to connect rails securely. Provide means for attaching top rail securely to each end, corner, line, slope and gate posts.
D. Joint Coupling: Galvanized steel, 6 inches long minimum for each joint. One coupling in 5 shall have expansion spring. Couplings shall be outside sleeve type with bore sleeve true to maintain adjacent lengths of rail in alignment

<table>
<thead>
<tr>
<th>TABLE No. 32 31 13-2.1</th>
</tr>
</thead>
</table>

**POSTS, FRAMES, STIFFENERS, RAILS**

<table>
<thead>
<tr>
<th>PROPOSED USE</th>
<th>NOMINAL TYPE AND SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>End, corner, slope and gate posts for single gates 6 feet or less in width and double gate 12 feet or less in width for</td>
<td></td>
</tr>
<tr>
<td>1. Fence less than 72 in. high</td>
<td>2&quot; pipe</td>
</tr>
<tr>
<td>2. Fence 72 inches or higher</td>
<td>2-1/2&quot; pipe</td>
</tr>
<tr>
<td>Gate posts for single swing gates over 6 feet, but not over 13 feet in width and double swing gates over 12 feet, but not over 26 feet in width or for all slide gates with leaves larger than 6 feet</td>
<td>3-1/2&quot; pipe</td>
</tr>
<tr>
<td>Gate posts for single swing gates over 13 feet, but not over 18 feet in width and double swing gates over 26 feet, but not over 36 feet in width</td>
<td>6&quot; pipe</td>
</tr>
<tr>
<td>Gate posts for single swing gates over 18 feet in width and double swing gates over 36 feet in width</td>
<td>8&quot; pipe</td>
</tr>
<tr>
<td>Frame for gates</td>
<td>1-1/2&quot; pipe</td>
</tr>
<tr>
<td>Stiffeners for gates</td>
<td>1-1/4&quot; pipe</td>
</tr>
<tr>
<td>Line posts for fences 72 in. or higher</td>
<td>2&quot; pipe</td>
</tr>
<tr>
<td>Line posts for fences less than 72 in. high</td>
<td>1-1/2&quot; pipe</td>
</tr>
<tr>
<td>Top Rail</td>
<td>1-1/4&quot; pipe</td>
</tr>
<tr>
<td>Bottom Rail</td>
<td>6-gauge, coiled spring steel tension wire</td>
</tr>
</tbody>
</table>

2.4 **CHAIN LINK FABRIC**

A. Eleven-gauge fabric for all fences less than 60 inches in height and 9 gauge for fences over 60 inches conforming to:
   1. ASTM A 392 for zinc coated steel fabric.

B. Unless indicated otherwise use chain link fabric that has approximately 2 inches square mesh and coated after fabrication.

C. Knuckle finish top edge and twist and barb bottom edge on fabric less than 60 inches wide. For fabric 60 inches or greater in width, twist and barb finish on both edges. Provide fabric that barbing has been done by cutting the wire on the bias.

D. provided fence with privacy slats
   1. Galvanized: In accordance with ASTM A 121, Class 3.

2.5 **TENSION WIRES AND FABRIC TIES**
The Church of Jesus Christ of Latter-day Saints
Garden City Assembly Hall

A. Tension wires: 7-gauge galvanized coil spring steel wire in accordance with ASTM A 641.

B. Fabric Fasteners: 9 gauge galvanized or 6 gauge aluminum wire, or approved non-corrosive metal bands, for ties to fasten fabric to posts, rails, and gate frames. Fasten fabric to bottom tension wire spaced 24 inches on center.

2.6 TRUSS OR TENSION BARS

A. Galvanized steel rod 3/8 inch diameter for truss or tension bars used in trussing gates frames and line posts adjacent in end, corner, slope, or gate posts. When used in trussing line posts, provide adjustment by means of galvanized turnbuckles or other suitable tightening devices.

B. Tension Bars:
   1. Galvanized high carbon steel bars not smaller than 3/16 inch x 3/4 inch for tensions bars to fasten fabric to end and corner posts and gate frames. Provide one tension bar for each end post and two for each corner and pull post per section of fabric.
   2. Use tension bar bands made from heavy pressed galvanized steel spaced on 15 inch center to secure tension bars to posts.

2.7 FITTINGS AND HARDWARE

A. Unless indicated otherwise, galvanize fittings and hardware in accordance with Section 05 03 05 – “Galvanizing.”

B. Rivets: Make all hardware attachments with galvanized steel rivets. Refer to ASTM F 626 for additional requirements.

2.8 SUPPORT OR EXTENSION ARM

A. Use support or extension arms for barbed wire that are of a type that can be attached to tops of the posts and carry the number of wires indicated.

B. Use only support arms on the fence for barbed wire that are capable of supporting a 250 pound vertical load at the end of the arm without causing permanent deflection.

C. Single support arms are to be integral with a top post weather cap and have a hole for passage of top rail when required.

2.9 GATES

A. Provide additional horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware and accessories.

B. Assemble gate frames and attach hardware by welding or by using fittings and rivets to make rigid connections. Use same fabric as for fence. Install fabric with stretcher bars to gate frame at not more than 15 inch on center.

C. Provide diagonal cross-bracing consisting of 3/8 inch diameter adjustable length truss rods on gates where necessary to prevent frame from sagging or twisting.

2.10 GATE HARDWARE

A. Hinges: Pressed steel or malleable iron to suit gate size, non-lift-off type, offset to permit 180-degree gate opening. Provide minimum of one pair of hinges for each leaf.
B. Latch: Forked steel type of plunger-bar steel type to permit operation from either side of gate. Provide locking device and padlock eye as integral part of latch.

C. Keeper: Provide keeper for all vehicle gates which automatically engages the gates leaf and holds it in the open position until manually release.

D. Gate Stops: Mushroom type or flush plate with anchors set in concrete to engage the center drop rod or plunger bar.

E. Sliding Gates: Manufacturer’s standard heavy-duty track, ball bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, steel wheel or rubber wheel, and accessories as required.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate utility location in accordance with Section 01 01 00 – “Summary of Work.”

B. Excavate in accordance with Section 31 22 22 – “Structural Excavating and Backfilling.”

C. Refer to ASTM F 567 and CLFMI products manual for chain link fence installation.

D. Protect existing trees.

E. Limit the amount of clearing and grading along the fence line to permit proper installation.

3.2 LAYOUT OF WORK

A. Accurately locate and stake locations and points necessary for installation of fence and gates.

B. General arrangements and location of fence and gates are indicated. Install except for minor changes required by unforeseen conflicts with work of other trades.

3.3 INSTALLATION OF POSTS

A. Space line posts as follows:
   1. Tangent sections to 500 feet radius: 10 feet maximum
   2. 200 feet radius to under 500 feet radius: 8 feet maximum
   3. 100 feet radius to under 200 feet radius: 6 feet maximum
   4. Under 100 feet radius: 5 feet maximum

B. Provide pull posts at 500 feet maximum intervals. Changes in line of 30 degrees or more are considered as corners.

C. Set all posts to true line and grade in concrete bases or in approved pipe sleeves sockets. Check for vertical and horizontal alignment.

   1. See Drawings for post foundation requirements.
D. Where posts are required to be set in concrete walls or masonry, set sockets for the posts to a depth of at least 18 inches. Use sockets that consist of lengths of 0.048 inch galvanized metal pipe sleeves, with an inside diameter sufficient to allow the posts to fit loosely therein. Coat the inside of the socket and outside of the posts with an approved bituminous paint. Caulk the posts securely in place with lead wool.

3.4 INSTALLATION OF BRACE ASSEMBLIES

A. Attach brace rail from end, pull, corner or gate posts to first ensuing line post. Install braces so posts are plumb when diagonal truss rod is under proper tension.

3.5 INSTALLATION OF RAILS

A. Install rails level and plumb with grade between posts and attached to posts before stretching fabric. Top rails shall form continuous brace from end-to-end of each run of fence.

3.6 INSTALLATION OF FENCE FABRIC

A. Place fence fabric on security side of posts unless otherwise specified. Place fabric approximately 1 inch above the ground. Maintain a straight grade between posts by excavating high points of the ground. Filling depressions with soil will be permitted only upon approval of ENGINEER.

B. Stretch the fabric taut and securely fasten to posts. Fasten to end, gate, corner, and pull posts. Secure stretcher bars with metal bands spaced at 15 inch intervals. Cut the fabric and fasten each span independently at all pull and corner posts. Fasten to line posts with tie wire, metal bands, or other approved methods at 15 inch intervals. Attach the top edge of fabric to the top rail or tension cable at approximately 24 inch intervals. Attach bottom tension wire to fabric with tie wires at 24 inch intervals and secure to the end of pull posts with brace bands.

C. Draw barbed wire to assure minimum sag at high temperatures and no breakage at low temperature. Connect the wires and arms by means of 0.142 gauge galvanized wire stays.

3.7 INSTALLATION OF GATES

A. Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage as recommended by the fence manufacturer. Adjust hardware for smooth operation.

3.8 REPAIR OF DAMAGED COATING

A. Grind smooth and wire brush all welds made after galvanizing to remove loose or burned zinc coating, after which neatly coat the areas with 50-50 solder or as otherwise directed by ENGINEER. Make repairs to abraded or otherwise damaged zinc coating in a similar manner.

END OF SECTION