TEXAS A&M UNIVERSITY
COLLEGE STATION, TEXAS

REED ARENA - RENOVATION OF
MEETING ROOMS, BUILDING #1554
Project Number 2018-03212

April 2019

PREPARED BY:

Patterson ✤ Architects
701 South Texas Avenue
Bryan, Texas 77803
PA Project No. 1857
PROJECT MANUAL

REED ARENA – RENOVATION OF MEETING ROOMS, BUILDING #1554
SSC Project # 2018-03212

Texas A&M University
College Station, Texas

PROJECT NUMBER: 1857

PATTERSON & ARCHITECTS
701 South Texas Avenue
Bryan, Texas 77803
(979) 775-6036

CLEARY ZIMMERMANN ENGINEERS
1344 S. Flores, Suite 101
San Antonio, Texas 78204
(210) 447-6100

GESSNER ENGINEERING
2501 Ashford, Suite 102
College Station, Texas 77842
(979) 680-8840

April 2019
Reed Arena - Renovation of Meeting Rooms
Building #1554

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- **S1.0** FRAMING PLAN
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REQUEST FOR COMPETITIVE SEALED PROPOSALS

SECTION 00 21 00

For SSC Services for Education

Texas A&M University

Project No.: 2018-02312

Project Title: REED ARENA RENOVATION OF MEETING ROOMS

Date: March 29, 2019
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Instructions for Proposals

Proposal Form and Pricing Schedule (Part 1)

Technical Proposal (Part 2)

Safety, Risk Assessment, Accident Prevention & Quality Control (Part 3)

HUB Subcontracting Plan (Part 4)

Sample Master Agreement Contract - Appendix A

UGSC

Special Conditions

Contractor Submittal Checklist

(Please use this checklist to ensure all the proper documents are provided)

Are parts 1-4 complete?
Is part 1 executed in ink?
Is submittal addressed correctly?
Is submittal on time?
Is submittal (hard copy and Flash Drive) properly labeled?
Is submittal in sealed envelopes?
1.0 GENERAL:

1.1 SSC Services for Education (SSC) as Owner Designated Representative (ODR) for Texas A&M University is requesting Competitive Sealed Proposals (CSP) from general construction contractors.

1.2 All data submitted with a Proposal, except as noted herein, is deemed to be part of the Contract.

1.3 Purchases made for State of Texas use are exempt from the State Sales tax and Federal Excise tax. Do not include tax in bid. Excise Tax Exemption Certificates are available upon request.

1.4 Payment for work performed will be in accordance with the SSC Uniform General and Supplementary Conditions ("UGSC"), subject to changes as provided for in the Construction Contract.

1.5 Proposal documents will be available via a Web Based file sharing program in a PDF format. All printing is the responsibility of the bidder.

2.0 RECEIPT OF PROPOSALS:

2.1 The review and approval of the CSP process is a multi-step process which requires variable amounts of time. Responders are advised that these projected dates may change as required.

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2.2 Location: Proposals are to be received at the office of the Owners Designated Representative:
David Ritter
600 Agronomy Rd, Suite 218
College Station, TX 77843

3.0 INFORMATION INQUIRIES:

3.1 Questions regarding the proposal process should be directed:
David Ritter: Project Manager
979-219-0774
David.ritter@sscserv.com

3.2 Inquiries regarding the technical aspects of the Construction Documents shall be directed to:
Fred Patterson
Patterson Architects
701 South Texas Avenue
Bryan, TX 77803
979-775-6036

3.3 Inquiries regarding the HUB documents shall be directed to:
Cindy Gillar
979-845-9010
c-gillar@tamu.edu

4.0 DISCREPANCIES AND INTERPRETATIONS:

4.1 Notify the ODR and A/E, in writing, at least five (5) business days prior to the scheduled Proposal opening date, if discrepancies, ambiguities or omissions are found in the Proposal/Construction documents, or if further information or interpretation is desired.

4.2 Answers will be provided in addenda format. All provisions and requirements of such addenda will supersede or modify affected portions of the Proposal documents. All addenda will be incorporated in and bound with the Contract Document. No other explanation or interpretation will be considered binding.

5.0 SUBMITTAL CONTENT & PROCEDURE:

5.1 Contents

- Proposal Form & Pricing Schedule (Part 1, Section 00 42 13)
  - Base Proposal & Accepted Alternatives
  - Construction Time
• Technical Proposal (Part 2, Section 00 45 16)
  o Company History
  o Experience & Qualifications (of company)
  o Current Project Workload
  o Ability & Qualifications of Professional Personnel
  o Methodology and Cost Control
  o List of Subcontractors

• Safety, Risk Assessment, Accident Prevention & Quality Control (Part 3, Section 00 45 17)
  o Safety History
  o Risk Assessment and Accident Prevention
  o Quality Control
  o HUB Subcontracting Plan (Part 4)
    Refer to HUB Subcontracting Plan (see separate attachment) for information and requirements (refer back to 3.3 for Inquiry information).
    (Submitted separately 24 hrs. after the proposal due date.)

5.2 Procedure

5.1.1 Submit Parts 1-3 as (1) hard copy in a sealed envelope clearly labeled “CSP Submission for Project Number 2018-03212 Parts 1-3” with Respondent’s Company Name clearly identified on the outside.

5.1.2 Submit Part 4 (HUB Subcontracting Plan) in a separate sealed envelope clearly labeled “HUB Subcontracting Plan for Project Number 2018-03212 with respondent’s Company Name clearly identified on the outside.
    (Submitted separately 24 hrs. after the proposal due date.)

5.1.3 Submit (1) digital copy in .pdf format of Parts (1-4) on a flash drive, which is to be included in sealed envelope containing Part 4.

5.1.4 ALL Parts (1-4) and flash drive are to be submitted by deadline as set forth in 2.1.

THE ODR IS NOT RESPONSIBLE FOR DOCUMENTS THAT CANNOT BE READ OR CONVERTED. UNREADABLE PROPOSALS MAY BE, AT ODR’S SOLE DISCRETION, REJECTED AS NONRESPONSIVE.
5.3 If the Proposal and all parts are submitted by mail, the address is:
   Facilities Services
   600 Agronomy Rd, Suite 218
   College Station, TX 77843
   Attn: David Ritter
   “PROPOSAL ENCLOSED”

5.4 Delivery of all Proposal parts prior to the advertised deadline(s) is the sole responsibility of the respondent.

6.0 PREPARATION OF COMPETITIVE SEALED PROPOSAL:

6.1 The Proposal must be based on conditions at the project site, the bidding documents and any addenda issued.

6.2 The Proposal, Part 1 must be authoritatively executed in ink and submitted on the Proposal Form.

6.3 A Proposal showing omissions, alterations, conditions, or carrying riders or qualifications which modify the Proposal Form & Pricing Schedule (00 42 13) will be rejected as irregular.

6.4 Only one Part 1 Proposal shall be submitted. If two or more Part 1 Proposals are submitted, either in one envelope or in separate envelopes, such multiple Proposals may be subject to rejection.

6.5 Proposal amounts may not be amended or modified in any manner after the time set for the bid opening. After all Proposals are publicly opened, but before they are read aloud, they will be examined by the presiding official to determine if they are in proper form and properly signed. If an error or omission is discovered and classified by the presiding official as a technicality which the ODR has reserved the right to waive, the respondent’s representative may be permitted to make the appropriate correction. Any such correction will be announced and explained to the others present at the Proposal opening. A Proposal which is not and cannot be made legible for consideration under this procedure will not be read, nor will the Proposal prices be revealed.

6.6 A respondent will receive no compensation or reimbursement of expenses incurred in the preparation of a Competitive Sealed Proposal submission.

6.7 All respondents are strongly urged to attend Pre-Proposal Conferences. Respondent attendance may be included as part of evaluation.
6.8 Proposals received after the advertised time for the bid opening will be ineligible and will be returned unopened.

6.9 The ODR reserves the right to reject any or all Proposals at any time prior to award.

7.0 PUBLIC INFORMATION AND NOTICE OF CONFIDENTIALITY:

7.1 The ODR considers all Proposal information, documentation and supporting materials submitted in response to these instructions to be non-confidential and/or non-proprietary in nature, and therefore, shall be subject to the public disclosure under the Texas Public Information Act (Texas Government Code, Sec. 552.001 et seq.) after the award of the contract. Portions of the respondent’s Technical Proposal which contains trade secrets or other proprietary data which must remain confidential shall be identified as below:

7.1.1 Mark the cover sheet of the Technical Proposal with the following phrase: “This Proposal includes data that shall not be disclosed outside of ODR and the A/E design team and shall not be duplicated, used or disclosed in whole or in part for any purpose other than to evaluate this Proposal.”

7.1.2 Mark each sheet and specific data on that sheet that the respondent wishes to restrict with the following phrase: “Use or disclosure of this specifically marked data is subject to the restrictions regarding confidentiality cited on the cover sheet of this Proposal.”

8.0 RESPONDENT REQUIREMENTS:

8.1 The ODR may make such investigations as necessary to determine the ability of the respondent to perform the Work, and the respondent shall furnish any requested information data including an audited financial statement within five (5) days of the Proposal Opening. The ODR reserves the right to reject any Proposal if the evidence submitted by, or investigation of, such respondent fails to satisfy the ODR that this respondent is properly qualified to complete the Work.

8.2 Each respondent submitting a Proposal must be prepared to furnish the firm’s State Comptroller Vendor Identification Number, or the date on which an application was submitted. Contract payments to the successful respondent are contingent on submittal of this identification number and on having a current Form W-9 on file with SSC.

8.3 Respondents must be in a “Taxpayer is not on Vendor Hold” status with the Texas State Comptroller’s Office in order to be awarded the contract. Respondent certifies this with the submittal of a properly executed proposal. Ref: Texas Comptroller of Public Accounts Taxpayer and Vendor Information. http://ecpa.cpa.state.tx.us/vendor/tpsearch1.html.
8.4 As required by Chapter 231 Texas Family Code, a Proposal for a contract to be paid from state funds must include the name and social security number of the sole proprietor, each partner, shareholder or owner with an ownership interest of at least 25 percent of the business entity submitting the Proposal.

8.5 The Texas Family Code requires each Proposal to include the following statement: “Under Section, 231.006, Family Code, the vendor or applicant certifies that the individual or business entity named in this contract Proposal or application, is not ineligible to receive the specified grant, loan or payment and acknowledges that this contract may be terminated and payment may be withheld if this certification is inaccurate.” Respondent agrees with this certification statement upon submittal of a properly executed Proposal.

9.0 OWNERSHIP OF THE COMPETITIVE SEALED PROPOSAL:

9.1 Submitted Proposals, documentation and supporting materials shall become the property of the ODR.

10.0 SITE INVESTIGATION:

10.1 It is the responsibility of each respondent to examine the project site, existing improvements and adjacent property and be familiar with existing conditions before submission of a Proposal.

10.2 After investigating the project site and comparing the Drawing and Specifications with the existing conditions, the respondent should immediately notify the ODR, in accordance with paragraph 4.0 of these Instructions for Competitive Sealed Proposals, of any conditions for which requirements are not clear, or about which there is any question regarding the extent of the Work involved.

10.3 Should the successful respondent fail to make the required investigation and should a question arise later as to the extent of the Work involved in any particular case, after receiving recommendations from the A/E, the ODR will make the proper interpretation of the Contract Documents.

11.0 EVALUATION AND CONTRACT AWARD PROCESS:

11.1 Proposals will be opened publicly. A proposal-tabulation will be issued once a contractor has been selected. Other contents of the Proposals will be afforded security sufficient to preclude disclosure of the contents prior to award or rejection action.

11.2 Proposals will be evaluated by the ODR and A/E & others as determined by SSC. The criteria for evaluation and selection of the successful respondent for this award will be based upon the factors listed below:

Instructions for CSP
Projects over $100,000
Page - 8 of 10
- **Base Proposal Amount & Accepted Alternate**: 51%

- **Construction Time**: 10%

- **Technical Proposal**: 24%
  - Experience & Qualifications
  - Current Project Workload
  - Ability & Qualifications of Professional Personnel
  - Methodology and Cost Control
  - List of Subcontractors

- **Litigation & Claims**: 5%

- **Safety, Risk Assessment, Accident Prevention & Quality Control**: 5%
  - Safety History
  - Risk Assessment and Accident Prevention

- **Quality Control**: 5%

**HUB Subcontracting Plan**
This is not a part of the evaluation and award process. However, missing, incomplete, or late submission of HUB Subcontracting Plan will result in disqualification of entire submission.

11.3 After opening the Proposals, the ODR/Owner will evaluate and rank each Proposal with respect to the published selection criteria described under Section 11.2. After opening and ranking, an award may be made on the basis of the initially submitted Proposal, without discussion, clarification or modification, or the ODR may discuss with the selected respondent, offers for cost adjustment and other elements of the Proposal. Other than the data read at the Proposal opening, the ODR shall not disclose any information derived from the Proposals submitted by competing firms in conducting such discussions.

11.4 If the ODR/Owner determines that it is unable to reach a satisfactory agreement with the first ranked respondent, the ODR will terminate discussions with that respondent. The ODR will then proceed with negotiations with each successive respondent as they appear in the order of ranking until an agreement is reached, or until the ODR has rejected all Proposals. After termination of discussions with any respondent, ODR will not resume discussions with that respondent.
11.5 Following the ODR/Owner approval of the order of ranking of respondent and the ODR contract award or Proposal rejection action, the respondents will be notified in writing.

11.6 The ODR/Owner reserves the right to accept or reject any or all alternates or to accept any combination of alternates considered advantageous.

11.7 The award or rejection action regarding the Proposal is at the sole discretion of the ODR/Owner and the ODR makes no warranty regarding this Proposal that a contract will be awarded to any respondent.

11.8 The ODR agrees that if the Contract is awarded, it will be awarded to the respondent offering the best value to the Owner. The ODR/Owner is not bound to accept the lowest priced Proposal if that Proposal is judged not to be the best value for the Owner, as determined by the ODR/Owner.

11.9 SSC Agreement
If applicable, provide comments pertaining to SSC’s Sample Master Agreement Contract (attached as Appendix A).

NOTE: SSC will not make significant changes to its Master Agreement Contract. Minor changes may be considered, SSC will not guarantee acceptance of such changes.

END OF SECTION
SSC Services for Education
Texas A&M University
Project No.: 2018-03212
Project Title: Reed Arena Renovation of Meeting Rooms

Business Name (Corporation, Partnership or Individual)

doing business as

hereby proposes to furnish and install all work required by the Contract Documents that includes, SSC Uniform General and Supplementary Conditions ("UGSC"), SSC Special Conditions, the Drawings, the Project Manual/Specifications and any Addenda issued prior to the Proposal.

The "Total Contract Cost" shall include the cost of delivery, insurance, bonds, taxes, labor, materials, supervision, overhead, profit, incidentals and the use of all equipment and tools required to complete the work. The proposed Contract Cost, indicated in the Pricing Schedule included shall constitute full compensation for work required by the Contract Documents and the Addenda.

- The RESPONDENT certifies that this proposal is made in good faith, without collusion or connection with any other person or persons offering a proposal for the same work, and that it is made in pursuance of and subject to all the terms and conditions of the Construction Documents for the work to be accomplished, all of which have been examined by the RESPONDENT.

- All work required by the Contract Documents and enumerated in the Pricing Schedule included, whether specifically mentioned, included by implication or appurtenant thereto, shall be performed by the RESPONDENT, irrespective of whether it is named in the Pricing Schedule.

- The Proposal will remain subject to acceptance for 90 calendar days after submittal, or for such longer time as the RESPONDENT may agree to in writing upon request by the Owners Designated Representative (ODR).

- The RESPONDENT will submit a construction schedule and execute the contract within 10 business days after notification of contract award.
<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>TOTAL PRICE</th>
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<tbody>
<tr>
<td>Contractor must list an amount for each line item pertaining to bid as required for the scope of this project OR bid may be disqualified for being incomplete.</td>
<td></td>
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<tr>
<td>Division 01 - General Requirements</td>
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<tr>
<td>Division 02 - Existing Conditions</td>
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<td>Division 03 - Concrete</td>
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<td>Division 04 - Masonry</td>
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<td>Division 05 - Metals</td>
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<td>Division 06 - Wood, Plastics and Composites</td>
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<tr>
<td>Division 07 - Thermal and Moisture Protection</td>
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<tr>
<td>Division 08 - Openings</td>
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<td>Division 09 - Finishes</td>
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<td>Division 10 - Specialties</td>
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<tr>
<td>Division 11 - Equipment</td>
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<tr>
<td>Division 12 - Furnishings</td>
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<tr>
<td>Division 13 - Special Construction</td>
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<td>Division 14 - Conveying Equipment</td>
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<td>Division 21 - Fire Suppression</td>
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<td>Division 22 - Plumbing</td>
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<td>Division 23 - Heating, Ventilating, and Air Conditioning (HVAC)</td>
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<td>Division 25 - Integrated Automation</td>
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<td>Division 26 - Electrical</td>
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<td>Division 27 - Communications</td>
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<td>Division 28 - Electronic Safety and Security</td>
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<td>Division 31 - Earthwork</td>
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<td>Division 32 - Exterior Improvements</td>
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<td>Division 33 - Utilities</td>
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<td>Division 34 - Transportation</td>
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<td>Division 44 - Pollution Control Equipment</td>
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<tr>
<td>Division 45 - Industry-Specific Manufacturing Equipment</td>
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</tbody>
</table>

**BASE PROPOSAL AMOUNT**
ITEM NO. 1 - BASE PROPOSAL AMOUNT
The amount for the complete construction of Reed Arena Renovation of Meeting Rooms, including all general, plumbing, mechanical, and electrical work indicated on the drawings by Patterson Architects dated 4/23/2019:

<table>
<thead>
<tr>
<th>BASE PROPOSAL AMOUNT</th>
<th>Dollars</th>
</tr>
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</table>

SUBSTANTIAL COMPLETION DATE
After Commitment Approval or Notice to Proceed issued by SSC Services for Education all of the work must be substantially completed no later than November 22, 2019. Final Completion shall be achieved within 30 consecutive calendar days after the date of Substantial Completion as determined by the ODR.

ALTERNATE 1 – C1, C2, and C3 light fixtures
(Contractor to indicate Alternate as an add or deduct along with a dollar amount and a number of days. If that number is “0”, contractor must write “0”. Items left blank will be disqualified for being incomplete.)

<table>
<thead>
<tr>
<th>ADD/DEDUCT</th>
<th>Dollars</th>
</tr>
</thead>
</table>

ADD/DEDUCT ________________________ Calendar Days

ALTERNATE 2 – NA
(Contractor to indicate Alternate as an add or deduct along with a dollar amount and a number of days. If that number is “0”, contractor must write “0”. Items left blank will be disqualified for being incomplete.)

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<tr>
<th>ADD/DEDUCT</th>
<th>Dollars</th>
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</thead>
</table>

ADD/DEDUCT ________________________ Calendar Days

ALTERNATE 3 – NA
(Contractor to indicate Alternate as an add or deduct along with a dollar amount and a number of days. If that number is “0”, contractor must write “0”. Items left blank will be disqualified for being incomplete.)

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<thead>
<tr>
<th>ADD/DEDUCT</th>
<th>Dollars</th>
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</thead>
</table>

ADD/DEDUCT ________________________ Calendar Days

ADDENDA – (Contractor must list number of Addenda issued or indicate “N/A”. If left blank bid will be disqualified for being incomplete.)

Respondent has received the following Addenda to the Request for Proposals, but agrees and understands that it will be responsible for performing the Work in accordance with all terms and conditions in all Addenda issued in connection with the Request for Proposals, and that its Proposal will be construed to include all requirements of all such Addenda:

Addenda No.(s)
The undersigned Respondent has carefully examined and considered the Project Site and relevant conditions and circumstances for the Work, information and requirements set out in the Request or Instructions for Proposals, the Drawings and Project Manual/Specifications, and the requirements of the proposed Contract Documents, including the ODR’s Agreement, the Uniform General and Supplemental Conditions, Special Conditions, and Tex. Gov. Code pertaining to Prevailing Wages Rates, in making this Proposal. Capitalized terms used but not otherwise defined in this Proposal Form shall have the same meanings as designated in the Request for Proposals.

The undersigned Proposer further agrees to the following conditions:
1. An incomplete Proposal or one having additional information or other modifications or qualifications inscribed thereon, may be cause for rejection of the entire Proposal.
2. That, if accepted by the Owner ODR, this Proposal becomes a part to the Contract Documents upon the signing of the Contract Agreement, and failing to comply with any part of this Bid will be taken as failure of the Proposer to comply with the Contract Documents, and will be just cause for rejection of the Work.
3. That the Owner reserves the right to reject any or all Proposals and waive any or all informalities and irregularities or to accept any Proposal considered advantageous to him.

<table>
<thead>
<tr>
<th>RESPONDENT:</th>
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<tr>
<td>Company</td>
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<tr>
<td>By:</td>
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<tr>
<td>Signature</td>
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<tr>
<td>Title</td>
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<td>Date</td>
</tr>
</tbody>
</table>

END OF SECTION
SSC Services for Education
Texas A&M University
Project No.: 2018-03212
Project Title: Reed Arena Renovation of Meeting Rooms

**NOTE:** Contractor must complete each item pertaining to this form or bid may be disqualified for being incomplete.

General Contractor's Name: ________________________________

Address: ________________________________________________

City, State, Zip: __________________________________________

Telephone No.: ___________________________ E-Mail: ______________

State Comptroller Vendor Identification Number: ________________

1.0 **GENERAL**

1.1 Qualification information submitted shall be applicable only to the Contractor’s office that will perform this Work.

2.0 **COMPANY INFORMATION & HISTORY**

2.1 ☐ Corporation ☐ Partnership ☐ Sole Proprietorship ☐ Joint Venture ☐ Limited Liability Company

State of Organization: ________________________________

2.2 How many years has organization been in business as a contractor? ____________

2.3 How many years has your organization been in business under its present business name? __________________________

2.4 Under what other or former names has your organization operated? ________________

2.5 List other fully staffed offices or fully staffed branch offices of your organization:

<table>
<thead>
<tr>
<th>Name/Location</th>
<th>Branch Manager</th>
<th>Telephone Number</th>
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<tbody>
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</table>

2.6 Corporate Officers, Partners or Owners of Organization:

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Construction Experience</th>
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</tbody>
</table>
2.7 If your organization is a corporation, answer the following:
• Date of incorporation: ________________________________
• State of incorporation: ________________________________
• President’s name: ________________________________
• Vice-president’s name(s): ________________________________
• Secretary’s name: ________________________________
• Treasurer’s name: ________________________________

2.8 If your organization is a partnership, answer the following:
• Date of organization: ________________________________
• Type of partnership, if applicable: ________________________________
• Name(s) of general partner(s): ________________________________

2.9 If your organization is individually owned, answer the following:
• Date of organization: ________________________________
• Name of owner: ________________________________

2.10 If the form of your organization is other than those listed above, describe it and name principals: ________________________________

2.11 List jurisdictions and trade categories in which your organization is legally qualified to do business, and indicate registration or license numbers, if applicable. ________________________________

2.12 List jurisdictions in which your organization’s partnership or trade name is filed. ________________________________

3.0 LITIGATION/CLAIMS
3.1 Has your organization ever failed to complete any work awarded to it? ________________________________

3.2 Are there any judgements, claims, arbitration proceedings or suits pending or outstanding against your organization or its officers? ________________________________

3.3 Has your organization filed any law suits or requested arbitration with regard to construction contracts within the last five years? ________________________________

3.4 Within the last five years, has any officer or principal of your organization ever been an officer or principal of another organization when it failed to complete a construction contract? ________________________________
4.0 EXPERIENCE & QUALIFICATIONS

4.1 List categories of work that your organization normally performs with its own forces.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

4.2 Propose to perform ______ % of the work for this project with own forces.
(List Trades) ___________________________________________________________________
________________________________________________________________________
________________________________________________________________________

4.3 List major construction projects your organization has in-progress and has completed within the past 5 years using a similar format to that shown below:
(Include as attachment at end of this document titled as “Current & Past Projects”)

FOR EXAMPLE ONLY

PROJECT PHOTO HERE

Name and Location of Project: ____________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Contract Amount: ______________
Percent Complete: ______________
Projected Completion Date: ___________

Owner Reference Contact:
Name ____________________________ Telephone ____________________________
Address __________________________

A/E Reference Contact:
Name ____________________________ Telephone ____________________________
Address __________________________
4.4 Total number and dollar amount of contracts currently in progress:
Number $__________________________

4.5 Largest single contract amount currently in-progress: $__________________________
Project Name: ________________________________
Projected Completion Date: ________________________________

4.6 Volume of work completed over last 5 years: (Through 12/31)
2017 $__________________________
2016 $__________________________
2015 $__________________________
2014 $__________________________
2013 $__________________________

4.7 List pending claims and/or litigation at time of submitting Proposal. (Show project name, owner and summary explanation.):
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

5.0 REFERENCES
5.1 Trade References:___________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

5.2 Bank References:___________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

5.3 Surety
• Name of bonding company:____________________________________________________
• Name and address of agent:____________________________________________________

6.0 ABILITY & QUALIFICATIONS OF PROFESSIONAL PERSONNEL
6.1 Project Organization Chart (Please attach at the end of this document)

6.2 Detailed resumes of individuals assigned to this project including project manager, superintendent, project scheduler/expediter, and quality control supervisors as applicable. (Please attach at end of this document)

6.2.1 Resumes of your key personnel shall include professional affiliations such as membership in the American Institute of Constructors and if the individual is a Level I or Level II Certified Professional Constructor.
6.2.2 In addition, a listing of other construction personnel within your organization that are members of the American Institute of Constructors shall be included and their respective level of certification.

6.3 Approximate amount of time each project team member is expected to spend on the project:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

7.0 METHODOLOGY & COST CONTROL

7.1 Please insert your methodology & cost control measures in a written form in this area. (If additional space is needed please insert additional sheets at the end of this document):

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

8.0 LIST OF SUBCONTRACTORS

8.1 Please list all subcontractors proposing to use on this project. (If additional space is needed please insert additional sheets at the end of this document):

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

9.0 PROPOSED PROJECT SCHEDULE

9.1 List procedures outlining how the contractor will update the Architect & ODR on progress of the project work schedule:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

9.2 Please attach proposed project schedule in Gant format at the end of this document.

END OF SECTION
NOTE: Contractor must complete each item pertaining to this form or bid may be disqualified for being incomplete.

1.0 SAFETY PROGRAM

1.1 Specify Type of Contractor: Check all that apply.

a. ____ General Construction
b. ____ Electrical
c. ____ Hazardous Abatement
d. ____ HVAC
e. ____ Plumbing
f. ____ Roofing
g. ____ Other, Specify: ___________________________

1.2 List your organization's Workers Compensation Experience Modification Rate (EMR) for the last five years, as obtained from your insurance agent.

2017 ______________
2016 ______________
2015 ______________
2014 ______________
2013 ______________

1.3 Complete matrix for the five past years, as obtained from OSHA No. 200 Log:

<table>
<thead>
<tr>
<th>Year</th>
<th>2017</th>
<th>2016</th>
<th>2015</th>
<th>2014</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injuries/illnesses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lost time accidents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Recordable cases</td>
<td></td>
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<tr>
<td>Fatalities</td>
<td></td>
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<tr>
<td>Direct hire fixed hours worked</td>
<td></td>
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</table>

(As needed to 1,000's)

1.4 Are regular project safety meetings held for Field Supervisor(s)?  □ Yes □ No
If yes, frequency: □ Weekly □ Bi-monthly □ Monthly □ As Needed

1.5 Are project safety inspections conducted?  □ Yes □ No
If yes, who performs inspection? ________________________________
How often? ________________________________
Who is required to attend? ________________________________

1.6 Does organization have a written safety program?  □ Yes □ No
If yes, provide a copy. It will become a compliance document upon contract award.
1.7 Does your organization have a safety orientation program...
For new employees? □ Yes □ No
For employees promoted to Field Supervisor? □ Yes □ No
If yes, does your Supervisor Safety Program include instructions on the following:

Safety work practices  □ Yes □ No
Tool box safety meetings  □ Yes □ No
First aid procedures  □ Yes □ No
Accident investigation  □ Yes □ No
Fire protection  □ Yes □ No
New worker’s orientation  □ Yes □ No

2.0 RISK ASSESSMENT AND ACCIDENT PREVENTION PROGRAMS
2.1 Submit a complete Risk and Accident Assessment Program at the end of this section.

3.0 QUALITY CONTROL PROGRAM
3.1 Submit a complete quality control program which will become a compliance document upon contract award.
3.2 This plan should address all aspects of quality control including responsibility for surveillance work, acceptance, rejection, documentation and resolution of deficiencies, trend analysis and corrective action and interface with Owner's inspectors.
3.3 Contractor to maintain documentation log of project progress including photos from beginning to end of project.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specifications Sections, apply to this Section.

B. Owner: The Board of Regents of The Texas A&M University System, an instrumentality of the State of Texas. The term “Owner”, “owner”, “Owner’s Designated Representative (ODR), or any other reference to the entity with whom the Contractor is bound in contract with, shall be synonymous for the extent of this contract and wherever found in the Contract Documents.

C. OWNER’S DESIGNATED REPRESENTATIVE (ODR): SOUTHEAST SERVICE CORPORATION d/b/a SSC Service Solutions, is herein referred to as “SSC,” or “Owner’s Designated Representative” (ODR). The ODR is the only party authorized to direct changes to the scope, cost, or time of the Contract.

1.02 DESCRIPTION OF WORK

A. Work to be done: The work to be performed under this contract and in accordance with these contract documents shall consist of furnishing all necessary plant, labor, materials, and constructing, installing, and performing all work shown and described in the contract documents, all of which are made a part thereof.

B. Character of Work and Mechanics: The Work shall be executed in the best and most workmanlike manner by qualified, careful, and efficient mechanics skilled in the trade, and in strict accordance with the contract documents and standards of the industry. Only certified journeymen in respective trades or apprentices under the direct supervision of certified journeymen will be permitted to install, supervise installation of, alter or replace electrical and mechanical systems including but not limited to: pipe, plumbing, HVAC systems, electrical wiring, fire protection systems, welding equipment and devices. A licensed plumber as defined by the Texas Plumbing License Law, section1301.002-#4, A-D., will accomplish installation, alteration and testing of gas systems. A current plumbing, mechanical and electrical license, as indicated in the Supplemental General Conditions, will be recognized as certification upon approval of the Owners Designated Representative. Licenses shall be available at the pre-construction conference and from plumbers, mechanics and electricians at the job site throughout the contract performance. Work accomplished by unlicensed mechanics shall be removed and reinstalled by the contractor using licensed mechanics at no additional cost to the University.

C. Project Title and Location:
   Project Title: Reed Arena - Renovation of Meeting Rooms, Building #1554
   Project No.: 2018-03212
   Project Location: Reed Arena, Texas A&M University
D. Contract Documents: Contract Documents, dated April 2019 were prepared for the project by Southeast Service Corporation (SSC), Facilities Services, Engineering, Design & Construction Services and/or their consultants by Patterson Architects.

E. The Work will be constructed under a general construction contract.

1.03 PRINCIPAL FEATURES:

A. The contractor will do all work with the building occupied and the contract work area unoccupied. The contractor shall coordinate all work with the Owner Designated Representative (ODR) and the building occupants.

B. Work of this contract can be summarized as follows:
   1. Demolition work includes the protection of Owner's furnishings during renovation activities. Also included is the removal of selected interior partitions, movable wall panels, ceilings and MEP equipment not scheduled to remain.
   2. The renovation work includes modifications/repairs to existing structural system fireproofing, interior gypsum wallboard partitions; building insulation; new folding partitions, suspended acoustical ceilings and typical interior finishes.
   3. The work also includes certain items of equipment including: fire suppression, plumbing, heating-ventilation-air conditioning; electrical systems; lighting and alarm-signal systems.

1.04 STARTING WORK:

A. The Contractor shall not start work until the eBuilder commitment approval or Notice to Proceed has been issued and all insurance certificates have been submitted, reviewed and accepted by the Owners Designated Representative (ODR).
   1. The Contractor shall provide and maintain the insurance coverage, with the minimum amounts required by the contract, until the end of the contract warranty period. The Contractor shall present the ODR a current certificate of insurance prior to performing contract work and any required warranty work.
   2. The Contractor shall update all expired policies prior to submission for monthly payment and during the contract warranty period. Failure to update policies shall be reason for withholding of payment until renewal is provided to the ODR.

B. The Contractor shall notify the ODR prior to commencing any contract work.

1.05 WORK HOURS, UTILITY OUTAGE AND COORDINATION:

A. Work Hours: Normal work hours at the University are 8:00 a.m. to 5:00 p.m., Monday through Friday. Contract work hours shall be Monday through Friday exclusive of holidays. Work may
be permitted on Holidays at the option of SSC and at no additional cost to SSC, with written notice to SSC at least 48 hours before the start of the scheduled work.

1. The Contractor may be allowed additional, or varied work hours, with prior approval by SSC.

B. The Contractor shall limit use of the premises to the work indicated and allow for occupancy and use during the construction.

C. Utilities:
1. Utility Outage: When a utility outage affecting occupied facilities is necessary to perform the contract work, the outage shall be performed during non-work hours at no additional cost to SSC. The contractor shall give written notice to SSC fourteen (14) days in advance of a scheduled outage. University personnel will perform disconnection and reconnection of utilities. Fourteen days advance notice is also required for connection and disconnection of temporary utilities by University personnel including but not limited to temporary water taps, electrical taps and other temporary site utilities.
2. Should Contractor discover “Unknown Utilities”, promptly notify the ODR’s personnel for direction. Such piping systems and lines shall be treated as charted lines discussed above.
3. Procedures for Notification if utility lines or piping systems are damaged during construction:
   a. Facilities Services Communications Center:
      College Station – 979-845-4811
      Gas Company: 911 (if gas lines are damaged)
   b. ODR Project Manager
   c. If unavailable, notify SSC/EDCS Resident Regional Manager: College Station at 979-446-2435.
4. COMMUNICATIONS AND DATA: Work on telephone, fiber optic lines, data lines and other communication systems must be performed by Texas A&M personnel and/or the telephone contractor. The Contractor shall coordinate his work with these agencies through the ODR.

D. Coordination: Contractor shall coordinate work with the Owner’s Designated Representative, prior to beginning any work on the project. Additionally, prior to starting work each day, the Contractor’s superintendent shall inform and coordinate with the Owner’s Designated Representative.

E. Cranes: When a crane is necessary to perform the contract work, the crane delivery, placement and lift dates shall be coordinated with the Owner’s Designated Representative, Environmental Health and Safety and others as may be required such as Texas Department of Transportation and local government. The Contractor shall give written notice to the University fourteen (14) days in advance of a required crane placement and lift. The Contractor shall submit a Crane Lift Plan with the written notice of crane placement and lift. The lift plan shall show the proposed crane location during the lift, the area of boom swing proposed for the lift, location and type of barricades, and affected streets, sidewalks, parking areas and buildings. The area of boom swing shall be depicted as the arc of the boom for the proposed swing with a radius of the boom length if the boom were in the horizontal. Contractor shall comply with OSHA and ANSI safety standards for cranes.

F. Inspection of Work: The Contractor shall not cover up any Work with finishing materials or other building components prior to an inspection of the Work by the ODR project inspector. Should corrections of the Work be required for approval, cover-up shall be delayed until another inspection can be made and approval is granted.
1. The Contractor shall be responsible for providing notification of at least seven (7) WORKING days, to the ODR project inspector of the anticipated need for a cover-up inspection. Should the ODR project inspector fail to make the necessary inspection within the seven (7) working days, the Contractor may not proceed to cover up the Work until the inspection has been completed.

2. The Contractor will notify the ODR project inspector a minimum of 24-hours in advance of any concrete pour. The ODR project inspector will inspect, approve or disapprove formwork, vapor retarder, fill, reinforcing/structural steel and utility line placements. Contractor will not pour concrete until the ODR project inspector has approved the Work.

1.06 UNIVERSITY OCCUPANCY

A. University Occupancy: University may occupy the adjacent facilities during the entire period of the contract operations. Cooperate fully with the University representative during contract operations to minimize conflicts and to facilitate University usage.

1.07 PARKING, STORAGE AND SITE RESTRICTIONS: Confine operations at the site to the areas permitted under the Contract. Portions of the site beyond areas for which work is indicated are not to be disturbed. Comply with the Owner's requirements concerning the Contractor’s operations and use of the premises, parking, loading and unloading.

A. Keep existing driveways and entrances serving the adjacent University facilities and parking spaces clear and available to the, visitors, staff and service vehicles at all times. Do not use these areas for parking or storage of materials.

B. Keep all storage areas free of debris, refuse, spills, leaks, stains, splashes and excess materials. All storage areas shall be maintained in a neat, clean, and safe condition. Do not unreasonably encumber the site with materials or equipment. Stockpiling of materials and the locations of storage sheds, trailers or temporary field offices shall be confined to the area designated by the University. If additional storage is necessary obtain and pay for such storage off site. Use of designated area(s) shall be coordinated with SSC/University.

C. Contractor storage and parking are at the job site in an area to be designated by SSC/University. Parking is not allowed on sidewalks, drives, or roadway. Do not block parking spaces.

D. Lock automobiles and other mechanized or motorized construction equipment, when parked and unattended, to prevent unauthorized use. Do not leave vehicles or equipment unattended with the motor running or the ignition key in place. Contractor shall not allow any construction equipment to be parked on adjacent streets at night.

E. Designated roads shall be used for construction traffic. Contractor shall not close, block, or otherwise obstruct roads at any time without written permission of the University and where required the local government. Contractor shall keep all debris and mud off all sidewalks and streets. Immediately clean all debris and mud that is a result of contract operations.
1.08 EXISTING FACILITIES AND CONDITIONS: Maintain the existing facilities in a safe condition throughout the demolition period.

A. Areas designated around, or near the building will be made available for contractor staging and dumpsters. Coordinate with ODR and University.

B. Prior to commencement of contract work, inspect areas in which work will be performed. Document and photograph existing conditions of structure, surfaces, equipment, and condition of surrounding properties, which could be misconstrued as damage resulting from demolition work or other contract operations. Inspection shall be verified, signed by, and filed with the Owner or Owners Representative prior to starting work.

C. Structural Building Components: Unless indicated on the Construction Documents, do not cut or modify any structural building component (e.g. column, beam, floor slab) without prior approval of Structural Engineer. If an existing structural component is accidentally cut, the remedial design work shall be by a Professional Structural Engineer licensed in Texas. The construction contractor is responsible for engaging the Structural Engineer and for payment of all design fees.

1.09 FIRE REGULATIONS: Comply with National Fire Protection Association, NFPA 241 guidelines. The contractor shall use no explosives or fire in performing the work. Contractor shall understand and comply with OSHA welding and cutting requirements.

A. Coordinate all work on existing fire alarm and fire suppression systems with the ODR inspector prior to the start of contract work. Any work that could cause dust or fumes must be coordinated with the ODR prior to commencing so the fire alarm system can be modified and protected as necessary.

1.10 CLEANUP: The contractor shall dispose of all trash, debris, refuse, garbage, etc., which is generated by the contractor during the contract. Building sites shall be cleaned on a daily basis and disposal shall be outside the limits of University property. Contractor shall routinely empty dumpsters to prevent wind-blown debris. Disposal shall be by sanitary landfill or other approved methods and shall conform to all local, state, and federal guidelines, criteria, and regulations.

1.11 ENERGY CONSERVATION: The contractor shall use good judgment in the conservation of utilities. Prevailing energy conservation practices shall be adhered to and enforced by the contractor.

1.12 SPECIAL STORAGE: The following shall apply when required to perform contract operations.

A. Petroleum Storage:
   1. The contractor shall store all fuel or petroleum products, whether new or used, in appropriate containers and within a bermed area with an impermeable liner (40 mil) or other approved containment measures. All storage areas shall be marked with appropriate signage (i.e., Flammable Storage - No Smoking Within 50 ft). All fuel tanks and petroleum storage containers shall be structurally sound and in good condition, be
1.13 TESTING PARAGRAPHS: Testing indicated in these contract documents to be performed by University or the Owner will be performed at the option of the University.

1.14 SAFETY:

A. Comply with all applicable Occupational Safety and Health Act (OSHA) Standards and Regulations.

B. Furnish and install all necessary safeguards to provide safety and protection of the public and University property adjacent to the contract work area. Comply with all applicable federal, state, and local laws, regulations, ordinances, policies and standards related to the safety of the public and University property while performing contract operations.

C. Speed Limit: Contractor shall notify all employees and subcontractors of the speed limit of the adjacent streets and ensure all personnel understand and comply with this requirement.

D. Temporary Traffic Controls: Furnish and install Temporary Traffic Controls (TTC) in accordance with the Texas Manual on Uniform Traffic Control Devices (TMUTCD). Submit a temporary traffic control plan for vehicular and pedestrian traffic to the project Engineer for approval prior to the start of construction operations. Pedestrian traffic control plans shall provide a safe, convenient and accessible travel path that replicates as nearly as possible the most desirable characteristics of the existing sidewalks or footpaths throughout all phases of construction. Provide for continuous operation of signs and barricades designating restricted or dangerous conditions including but not limited to: illuminated barricades, danger signals, warning signs and obstructions.

E. Site Safety: Do not leave the work areas in an unsecured or unsafe condition at any time during contract operations. Contractor personnel and equipment operators shall monitor their surroundings at all times and be alert for people moving in or adjacent to contract work areas. Contractor shall use spotters when moving vehicles through the construction sites and no kept sealed when not in use, and be grounded and bonded according to NFPA Requirements.

2. The containment area shall be sized to hold fluid volume equal to 110% of the largest storage container, with a minimum of one foot of freeboard for earthen berms. The contractor shall immediately clean up and dispose of any evidence of a fuel or oil spill in conformance with all federal and state regulations at no additional cost to the University.

3. The contractor shall remove bermed areas at the completion of the job and restore the area to its original condition. The contractor shall immediately clean up and dispose of any evidence of a fuel or oil spill in conformance with all federal and state regulations. Costs of all soil tests as a result of spills shall be a responsibility of the contractor.

4. The contractor shall keep all other storage areas free of debris, leaks, stains, or splashes. All storage areas shall be maintained in a neat, clean, and safe condition. Any areas that incur contamination by any hazardous substance shall be immediately remediated by the contractor at no additional expense to SSC/University. Remediation may include subsequent soil analysis if directed by SSC/University. The contractor shall store all paints, thinners, solvents and other hazardous materials in a contractor supplied trailer or storage unit, which shall be secured when not in use.
construction vehicles (i.e. backhoes, bobcats, etc.) shall be left unsecured on site. Contractor shall furnish and install temporary fences, barricades, signs and other required items to:
1. Warn/notify adjacent building occupants
2. Protect construction materials
3. Prevent unauthorized personnel from entering the construction site.
4. Redirect vehicular and pedestrian traffic flow when required to perform contract operations; comply with paragraph E above, Temporary Traffic Controls.

F. Prior to spraying paint, coatings or power washing exterior structures the following criteria shall be met:
1. Contractor shall provide ODR and University forty eight (48) hours’ notice prior to spraying any material, including primer, paint or coatings.
2. Consider use of dry-fall paint when spray painting large areas of structure (e.g. metal building frames) or materials by conventional or airless spray.
3. The Contractor shall provide all necessary barricades, signs, warning of spray area as determined in the preconstruction conference. The Contractor shall set these signs out the night before spraying begins.
4. The Contractor shall be responsible for the removal of signs and barricades at the completion of the job.
5. The Contractor shall protect any automobile, bicycle, vehicle or other property which is located in a warning area where contact with the Owner has not been made.
6. The Contractor shall employ approved wind screens, protective shrouds and other protection methods during all paint and coating applications. The Contractor is responsible for all overspray and shall have sole liability where damage occurs as a result of this work.
7. Spray equipment shall be as recommended by the materials manufacturer. Spray operations shall be performed only during adequate period of calm weather with winds not exceeding 15 miles per hour. Protect all property from overspray or other damage.
8. To prevent sparking a flammable substance, smoking and other sources of flame near spray painting operations are prohibited and tools shall be properly rated and grounded for work in a spray painting area.

1.15 TREES, SHRUBS, AND HEDGES: Coordinate all tree protection procedures through SSC Grounds Management. Take appropriate measures to prevent injury to plants in or near the project site unless designated to be removed. Do not remove or prune any plants without approval from SSC/University or designated representative. No tree, shrub or hedge, or portion of a tree, shrub or hedge shall be removed that contains actively nesting birds unless approved by SSC/University. Actively nesting migratory birds will also require a permit be obtained from the U.S. Fish and Wildlife Service. Plants which are damaged during construction shall be replaced at no expense to SSC/University. Contractor shall remove all trees, tree branches, shrubs and plants that will interfere, encroach upon, or otherwise obstruct new construction and contract operations at no additional cost to SSC/University.

1.16 ENVIRONMENTAL REQUIREMENTS:

A. Compliance with Environmental Laws: The contractor shall comply, and assure that all subcontractors comply, with all applicable federal, state, and local laws, regulations, ordinances, policies and standards related to environmental matters. The contractor shall also
comply, and assure that all subcontractors comply, with all applicable specific instructions, policies, or references contained herein.

B. Contractors involved in projects that include the removal and/or disposal of polychlorinated biphenyl (PCB) contaminated light ballasts shall comply with the requirements of 40 CFR 761. PCB containing ballasts are a special waste and must be managed as such. The contractor shall immediately notify SSC/University when activities involving the removal of PCB light ballasts begin.

Contractors involved in projects that include the removal and/or disposal of fluorescent, mercury vapor, or HID Sodium Vapor lamps shall comply with the requirements of this section. Fluorescent lamps have been determined, by the TCEQ to be hazardous waste and must be managed in accordance with 40 CFR 260-279, and 30 TAC 330-335. The contractor shall immediately notify SSC/University when activities involving the removal of the aforementioned lamps begin.

C. Nuisance and Polluting Activity Prohibited: Polluting, dumping, or discharging of any harmful, nuisance, or regulated materials (such as concrete truck washout, vehicle maintenance fluids, residue from saw cutting operations, solid waste and hazardous substances) into building drains, site drains, streams, waterways, holding ponds or to the ground surface shall not be permitted. The contractor shall be held responsible for any damages that may result. Further, the contractor shall conduct activities in such a fashion to avoid creating any legal nuisance, including but not limited to, suppressing noise and dust, controlling erosion, and implementing other measures as necessary to minimize off-site impacts of work activities.

D. Should the contractor encounter previously unidentified and suspect asbestos-containing materials (ACM), mold, hazardous or potentially hazardous material or suspected lead containing paint which must be disturbed to comply with the contract documents, the contractor shall cease all work that would disturb the suspect material and shall immediately notify the Owner’s Designated Representative. The Owner shall take steps, as appropriate, to ascertain the material’s composition and determine any remedial action necessary. The Contractor will remove contract work crews from the area of the work site affected by the suspect materials and continue work on other parts of the project as feasible. Contractor shall return to abandoned work area after the owner has determined the composition of the suspect material and completed any required remedial action.

E. Contractor is responsible for all materials brought on site, including hazardous materials. All hazardous waste or special waste generated by the contractor as a result of contract operations shall be identified, characterized, containerized and transported to a permitted disposal facility in strict accordance with the requirements of 40 CFR 260-279 (Hazardous waste and used oil regulations), 30 TAC 324, 330-335 (TCEQ Hazardous and Industrial Waste Regulations).

1.17 WARRANTY PERIOD: Except as may be otherwise specified in the Contract Documents, the Contractor shall repair all defects in materials, equipment, or workmanship appearing within one year from the date of Substantial Completion of the Work. If Substantial Completion occurs by phase, then the warranty period for that particular Work begins on the date of such occurrence, or as otherwise stipulated on the Certificate of Substantial Completion for the particular Work.
1.18 COLOR AND MATERIAL SELECTIONS:

A. No color selections and no material selections will be made by SSC/University until the contractor submits all samples of all materials requiring color selections to SSC/University. In addition, prior to SSC/University selecting colors, the contractor shall certify in writing that all colors and samples submitted are current and are acceptable to the contractor for SSC/University’s selection.

B. Any samples that are not applicable to the contract shall be carefully removed from the submittal by the contractor. The contractor shall submit the manufacturer's full range of applicable colors, patterns, and textures for the various materials that are required by the contract and within the guidelines hereinbefore stated.

C. In the event that discontinued, non-current or non-applicable colors, textures, or samples are submitted by the contractor and their selection is made by SSC/University, the contractor shall bear all labor and material correction costs for fabrication, shipping, restocking, removal, repair of damaged materials, and installing of all materials required by SSC/University to correct the project.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION
SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.01 SECTION INCLUDES:
   
   A. This Section includes administrative and procedural requirements for alternates.

1.02 RELATED SECTIONS:
   
   A. Section 01 10 00 - Summary of Work.
   
   B. Divisions 02 through Division 33: Specific sections could be affected by any Alternate.

1.03 DEFINITIONS
   
   A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

   B. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

   C. Alternate bid prices shall include the cost of delivery, insurance, taxes, labor, materials, supervision, overhead, profit, incidentals and the use of all equipment and tools required to complete the specified alternate work. The alternate bid price shall constitute full compensation for work required by the alternate.

1.04 PROCEDURES
   
   A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

   B. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate. Coordinate related Work and modify surrounding Work as required to complete the Work, including changes required by each Alternate, designated in the Contract.

   C. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

   D. Execute accepted alternates under the same conditions as other work of the Contract.

   E. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.
1.05 DESCRIPTION OF ALTERNATES:

A. Alternate No. 1 – C1, C2 and C3 Light Fixtures
   State amount to be added to base bid for furnishing material and labor to install alternate light fixtures as indicated on the drawings.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION
SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. General requirements for product options and substitution procedures.
B. Material and product options.
C. Substitutions.
D. Coordination.

1.02 RELATED SECTIONS:

A. Section 01 10 00 - Summary of Work.
B. Section 01 31 00 - Project Management and Coordination
C. Section 01 33 00 - Submittal Procedures
D. Section 01 34 00 - Shop Drawings, Product Data and Samples.
E. Section 01 60 00 - Product Requirements.
F. Section 01 77 00 - Closeout Procedures.

1.03 GENERAL:

A. In addition to Uniform General and Supplementary Conditions, comply with product option and substitution requirements specified in this Section.

1.04 MATERIAL AND PRODUCT OPTIONS:

A. Materials and Products Specified by Reference Standards, by Performance, or by Description Only: Any product meeting specified requirements.

B. Materials and Products Specified by Naming Products of One or More Manufacturers with a Provision for an Equivalent Product: Submit one of the products listed which complies with specified requirements or submit a request for substitution for a product of manufacturer not specifically named which complies with specified requirements.

C. Materials and Products Specified by Naming Products of Several Manufacturers Meeting Specifications: Submit one of the products listed which complies with specified requirements or submit a request for substitution for a product of manufacturer not specifically named which complies with specified requirements.
1.05 SUBSTITUTIONS

A. Within sixty (60) days after date of Owner's Notice to Proceed, A/E will consider requests from Contractor for substitutions. Subsequently, substitutions will be considered only when a material or product becomes unavailable due to no fault of Contractor or as follows:
   1. Lockouts,
   2. Strikes,
   3. Bankruptcy,
   4. Discontinuation of product,
   5. Proven shortage,
   6. Other similar occurrences.

B. Each proposed substitution of materials or products for that one specified is a representation by Contractor that it has personally investigated the substitution and determined that the proposed substitution is equivalent or superior to that specified in quality, durability and serviceability, design, appearance, function, finish, performance, and of size and weight which will permit installation in spaces provided and allow adequate service access. Additionally, Contractor agrees that it will provide and/or do the following:
   1. Same warranty on substitution as for specified product or material,
   2. Coordinate installation and make other changes that may be required for Work to be complete in all respects,
   3. Waive claims for additional costs which may subsequently become apparent,
   4. Verify that proposed materials and products comply with applicable building codes and governing regulations and, where applicable, has approval of governing authorities having jurisdiction.

C. The A/E will review requests from Contractor for substitutions with the ODR. Do not purchase or install substitute materials and products without written approval. The A/E will give written notice to Contractor and the ODR of acceptance or rejection within a reasonable time.

D. Document each request for substitution with complete data substantiating compliance of proposed substitution with Contract Documents. As appropriate include:
   1. Reason for the proposed substitution,
   2. Change in Contract Sum and Contract Time, if any,
   3. Effect on WPS and completion date,
   4. Changes in details and construction of related work required due to substitution,
   5. Drawings and samples,
   6. Product identification and description,
   7. Performance and test data,
   8. Itemized comparison of the qualities of the proposed substitution to the product specified including durability, serviceability, design, appearance, function, finish, performance, size and space limitations, vibration, noise, and weight,
   9. Availability of maintenance service, source and interchangeability of parts or components,
   10. Additional information as requested.

E. In the event of credit change in the cost, the Owner shall receive all benefit of the reduction in cost of the proposed substitution. Credit shall be established prior to final approval of the proposed substitution and will be adjusted by Change Order.
F. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals without separate written request, without having been reviewed and approved by Contractor, or when acceptance will require substantial revision of Contract Documents without additional compensation to A/E.

G. In the event that the Contractor or Subcontractor has neglected to place an order for specified materials and products to meet the WPS, specified requirements, color schemes or other similar provisions, such failure or neglect shall not be considered as legitimate grounds for an extension of completion time nor shall arbitrary substitutions be considered to meet completion date.

H. Only one request for substitutions will be considered for each product. When substitutions are not accepted, the Contractor shall provide specified product.

I. Should substitution be accepted, and substitution subsequently is defective or otherwise unsatisfactory, replace defective material with specified material at no cost to Owner.

1.06 COORDINATION:

A. When a specified, optional, specified by reference standard, or proposed substitution item of equipment or material is submitted which requires minor changes or additions to the designed structure, finishes or to mechanical and/or electrical services due to its requirements being different from those shown on the Contract Documents, itemize the changes required and attach to submittal. Do not proceed with changes without written approval from the A/E.

B. Contractor shall make adjustments and changes required to coordinate Work for installation of optional materials and products, approved substitutions and materials and products specified by reference standards without additional costs to Owner or A/E.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION
SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES:

  A. Payment requests.

1.02 RELATED SECTIONS:

  A. Section 01 11 00 - Summary of Work.
  B. Section 01 77 00 - Closeout Procedures.
  C. Section 01 34 00 - Shop Drawings, Product Data and Samples.

1.03 PAYMENT REQUESTS:

  A. General: Except as otherwise indicated, the progress payment cycle is to be regular. Each application must be consistent with previous applications and payments. Certain applications for payment, such as the initial application, the application for final payment involve additional requirements. Refer to the Uniform General and Supplemental Conditions (UGSC) for additional requirements.

  B. Progress Payments will be accomplished through eBuilder utilizing a payment application approval process.

  C. At the earliest convenient time, but not later than 21 days after the Notice to Proceed, the Contractor shall develop a Schedule of Values (SOV) to reflect the value of the categories of work. The categories will be as required by the OWNER to facilitate componentization of the work by the OWNER. The ODR will provide the required categories at the pre-construction meeting. If more than one building is involved, the breakdown shall be by building. All exterior work involving utilities, landscaping, sidewalks, etc., should be identified as separate items.

    1. The initial SOV may require some revisions by the Contractor after the ODR’s review. It is, therefore, recommended that this schedule be prepared and submitted as soon as possible to prevent delay of the initial payment to the Contractor.

    2. The ODR’s initial interest in the SOV is to assure that the breakdown is in sufficient detail to meet the above requirements. After this requirement is satisfied, the A/E and ODR will review the schedule to assure that reasonable dollar values are assigned to the various items of work and to avoid front loading of payments.

    3. Computer generated or photo copied schedules of values prepared by the Contractor using the approved breakdown are acceptable.
D. MONTHLY PAYMENT ESTIMATES:

The A/E will show approval of the monthly pay estimate by affixing their signature to the original pay estimate. The original pay estimate will be forwarded to the OWNER for further processing.

1. Limitations - Estimates will not be approved if the job site record drawings are not up to date and posted per the UGSC. Estimates will also not be approved if other periodic requirements are not provided, i.e., WPS, Cash Flow Schedule, Required Logs, etc.

2. Historically Underutilized Business Progress Assessment Report (PAR) will be prepared and submitted with the pay request each month in accordance with Uniform General and Supplementary Conditions. Pay requests will not be approved without this completed form. The HUB Progress Assessment Report will be submitted even when no Hub Subcontractor payment is made during the pay period.

3. Contract Change Statement - All approved Change Orders should be entered on the Contract Change Statement. This Statement will then be attached to the Contractor's monthly payment estimate. Percentages complete should be shown opposite each item listed and extended into the "Total Complete to Date" column. The total of the "Total Complete to Date" should be brought forward to the line item on the breakdown schedule titled, "Changes Complete to Date".

4. Payment for Stored Materials - Invoices for stored materials will be submitted when required by the ODR. Stored material invoices will be accepted only after an approved shop drawing or sample has been received by the ODR.

Invoices for stored materials will only be considered when they exceed five hundred dollars ($500) for each individual item. There will be no invoices accepted that contain tools, or expendable materials.

Invoices will only be considered that are referenced to the materials in the SOV. Invoices that are not legible will not be considered for payment.

All stored materials will be checked by the Project Superintendent and verified by the ODR before being incorporated into the payment estimate.

5. Payment of Estimates – The ODR will process the Contractor's estimates as promptly as possible. In order to do this, it is requested that these instructions be followed and that the Contractor make every effort to ensure that the estimate is mathematically correct and that only approved items are included as material stored on the site.

D. Base applications for payment on value of work installed, and materials and equipment suitably stored at Site. Materials and equipment suitably stored off site in an insured or bonded warehouse may be included, if approved in writing by ODR. See UGSC for additional requirements when requesting payment for materials stored off site.

E. Payment for Stored Materials: The ODR shall be the sole authority for approval (proof of insurance or bond will be required).

1. Where the Schedule of Values separates items into labor amounts and material amounts, payment will be made for materials delivered and suitably stored on Site provided said material is required for installation according to the Contractor’s Work
Progress Schedule (WPS).

2. Materials stored at an off site location which are eligible for inclusion on progress payments are defined as finished goods made specifically for the Project, provided said material is required for installation according to the Contractor’s WPS. Raw materials, work in progress at fabrication plants, and commodity items readily available for purchase are not eligible for inclusion in Contractor's Application for Payment.

3. Payment will be made under following provisions:
   a. Items are listed separately on Application for Payment.
   b. Include with Application for Payment:
      (1) Paid receipts showing Contractor is unconditional owner.
      (2) Fully executed Transfer of Title on photocopy of form provided herein.
      (3) Location where materials are stored if off site, and method used to store.
      (4) Identify items in off site storage as property of Owner and furnish description of identification method.
      (5) Inventory of items and methods used to verify inventory, including Contractor's certification that quantities have been received in good order.
      (6) Proof of insurance for materials stored off site, in Owner's name.
      (7) Proof of transportation arranged for delivery of material stored off site.
      (8) Material delivered and stored on site or off site needs to parallel WPS.
   c. ODR reserves right to verify storage by physical inspection at any time.
   d. Payment does not relieve Contractor's obligations to protect, transport and install materials.
   e. Title of materials upon which partial payments are made shall transfer to Owner. Partial payment does not constitute acceptance by ODR nor a waiver of any right or claim by ODR. Any costs incurred by Owner shall be paid by Contractor.

F. Final Payment Application (see UGSC): Administrative actions and submittals must precede or coincide with submittal of Contractor's final payment application.
   1. Complete project closeout requirements specification in Section 01 77 00 and 01 78 00.
   2. Additions and deductions resulting from Change Orders.
      a. Original Contract Sum.
   3. The Owner will prepare final Change Order, reflecting approval adjustments to Contract Sum not previously made by Change Orders.
   4. After final acceptance of the work, the Contractor shall submit their final payment application in the same manner as a progress payment, indicating this is the final payment application. Include waivers of lien release with final pay application. When Federal Funds or other grant funds are included, approval of that agency may also be required.
G. Cash Flow Schedule (When required by the Owner): Cash Flow Schedule will be required within 21 days after approval of the SOV. This schedule shall show monthly payment requirements for the duration of the Contract. The schedule shall include a graphic analysis showing anticipated total completed to date accounts versus actual completed to date amounts. This Cash Flow Schedule is required to be updated monthly and submitted with each payment estimate.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION
SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Coordination of Contract Work.
B. Correspondence.
C. Meetings.
D. Coordination of Submittals.
E. Coordination of Contract Closeout.
F. Coordination with Local Personnel.

1.02 RELATED SECTIONS:

A. Uniform General and Supplementary Conditions Article 3
B. Section 01 11 00 - Summary of Work.
C. Section 01 25 00 - Substitutions Procedures.
D. Section 01 31 50 - Project Meetings.
E. Section 01 32 00 - Construction Progress Documentation
F. Section 01 33 00 - Submittal Procedures
G. Section 01 34 00 - Shop Drawings, Product Data and Samples
H. Section 01 60 00 - Product Requirements.
I. Section 01 73 50 - Cutting and Patching.
J. Section 01 77 00 - Closeout Procedures.
K. All Divisions of Facility Services Subgroup

1.03 COORDINATION, GENERAL:

A. Coordinate all portions of the Work under the Contract. Require each Subcontractor to coordinate their portion of the Work and provide their requirements for coordination of their Work with other related Work. (see UGSC)
Contractor shall require and be responsible for cooperation and coordination between various trades and Subcontractors whose work is dependent upon one another. Schedule such work so as to prevent delays in dependent work and so that all related work will progress together. Fully inform each trade or Subcontractor of the relation of its work to other work, and require each to make necessary provisions for the requirements of such other work. No additional compensation for extra work incurred through the lack of cooperation and coordination between various trades and Subcontractors will be allowed.

B. Coordinate mechanical and electrical Work with that of other trades in order that various components of systems are installed at proper time, fit available space, and allow proper service access to those requiring maintenance, including equipment specified in other Divisions.

C. Coordinate Work of sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate use of Project space and sequence of installation of mechanical, plumbing, and electrical Work which is indicated diagrammatically on Drawings. Follow routings shown for pipes, ducts, and conduits as closely as practicable, with proper allowance for available physical space; make runs parallel with lines of building. Utilize space efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas, except as otherwise shown, conceal pipes, ducts, conduit, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements. Provide escutcheon plates at penetrations through finished walls and ceilings with finish appropriate to adjacent finished surface.

F. Coordination Drawings: Before materials are fabricated or installation of the Work, prepare coordination drawings (Section 01 34 00). Prepare drawings including plans, elevations, sections, and details as required to clearly define relationships between all building trades including HVAC, Electrical, Plumbing, Fire Sprinkler Systems and the structural components of the building such as ceilings, beams, columns, walls and floors. The drawings shall clearly define locations of sleeves, floor penetrations, Plumbing and HVAC piping, ductwork, equipment, light fixtures, electrical and control wiring conduits, panels, and their relationship to building structural components.

1. In preparation of the coordination drawings the Contractor is required to hold coordination meetings with all trades providing the above Work for each building level and each mechanical and electrical room.

2. Resolve conflicts between trades and prepare composite coordination drawings and submit six (6) sets of drawings to the A/E and one set to ODR. Allow sufficient time for review, in accordance with submittal procedures, prior to proceeding with fabricated or installation of the Work.

a. Prepare CAD coordination drawings to 3/8” = 1’0” scale for each floor level and for each mechanical and electrical room. The drawings shall indicate all work items located on each level shown on the drawing with the work items indicated by the following colors:

   Building and structural components  black
   HVAC ductwork and diffusers  dark green

Project Management
Page 01 31 00 - 2 of 6
b. All piping and ductwork larger than 2½” in diameter shall be drawn two line; smaller piping and ductwork shall be drawn double thickness single line.

c. Show access space around equipment as directed by Specifications.

d. The superintendent for each trade and the Contractor shall sign the drawing indicating that he has reviewed the drawing for accuracy.

3. When conflicts cannot be resolved, Contractor shall request clarification from the A/E prior to proceeding with that portion of the Work affected by such conflicts or discrepancies. Prepare interference Drawings to scale and include plans, elevations, sections, and other details as required to clearly define the conflict between the various systems and other components of the building such as beams, columns, and walls, and to indicate the Contractor's proposed solution.

G. Remove and relocate items which are installed without regard to proper access, as directed by the A/E and ODR, at no additional cost to the Owner.

1.04 CORRESPONDENCE:

All correspondence relating to this Project should occur in eBuilder. Correspondence outside of eBuilder must show the Project name, Project number and Contract number and must be uploaded to eBuilder.

1.05 MEETINGS:

A. In addition to project meetings specified in Section 01 31 50, hold coordination meetings and pre-installation conferences with appropriate personnel to assure coordination of Work.

1.06 COORDINATION OF SUBMITTALS:

A. Schedule and coordinate submittals specified in Sections 01 32 00, 01 33 00, 01 34 00, 01 25 00 and 01 77 00 and other Sections of Divisions 2 through 35.

B. Coordinate requests for substitutions to assure compatibility of space, of operating elements, and effect on Work of other sections.

1.07 COORDINATION OF CONTRACT CLOSEOUT:

A. Coordinate completion and cleanup of Work of separate sections in preparation for Substantial Completion.

B. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.
1.08 COORDINATION WITH LOCAL PERSONNEL:

A. Problems concerning traffic, parking or blocking streets must be referred to the appropriate campus personnel. Confine truck route egress and exit to Site as indicated on Drawings. Coordination is to be through the ODR.

B. Any exterior problems, including the moving of utilities is to be referred to the Facilities Services. Coordination is to be through the ODR.

C. The scheduling of utility outages must be coordinated with the Physical Plant of the campus at least fourteen (14) days in advance. This coordination is to be arranged through the ODR.

1.09 PROTECTION:

A. Contractor shall assume responsibility for initiation and maintenance of protective requirements specified in Section 01 50 00, Temporary Facilities and Controls.

1.10 REPAIR OF DAMAGE:

A. Damage: Restore accidental or careless damage to the Work to a condition as good as or better than existed before work was commenced and at no cost to the Owner.

1.11 SECURITY:

A. Conform to requirements of public laws, ordinances and regulations and requirements of insurance carriers concerning security of Site while Work is in progress as well as when it has been suspended, if this occurs.

1.12 RECORD DOCUMENTS:

A. Maintain project record documents at Site. Refer to Section 01 77 00 for requirements.

1.13 CONSTRUCTION LOADING:

A. General: Concrete slabs on grade and suspended floors have not been designed for heavy loading.

B. Slabs On Grade: Do not subject slabs on grade to excessive loading by shoring, storage of materials or operation of construction equipment unless adequately protected by planking. Maintenance of slabs in good condition is the responsibility of the Contractor, who shall remove all damaged areas of such slabs and replace them with new work at no cost to Owner.

C. Suspended Floors: Do not subject suspended slabs to construction loads beyond 40 pounds per square foot unless adequately shored. Such shoring shall be designed for the Contractor by a registered (Texas) Structural Engineer, who shall certify prior to imposing construction loads on slabs, that the shoring as installed conforms with the shoring as designed. Submit three prints, for record only, of the shoring drawings to the A/E, signed by the Contractor's design engineer.
1.14 SPECIAL REQUIREMENTS:

A. Existing Utilities: Schedule shut downs if needed in order to minimize inconvenience to Owner. Notify ODR in writing fourteen (14) days in advance of any anticipated shutdowns. Utility shutdowns will only be scheduled at a time mutually agreeable to the Owner and Contractor.

B. Existing Valves and Switchgear: Owner will be responsible for opening and closing all valves and switches on all utility services. This will be done by University's Facilities Services/Physical Plant personnel without cost, except when overtime work is required.

C. Damaged Utilities and Services: When existing utilities are damaged, SSC Facilities Services shall make repairs or permit Contractor to make repairs under supervision of SSC Facilities Services personnel. If repairs are to utilities shown on Contract Documents, all costs or repairs incurred by Owner will be borne by Contractor.

D. No additional compensation will be made to Contractor for reasons of premium time, after hours, overtime or for inefficiency of operation.

E. Parking: Restricted to areas indicated on Drawings for Contractor's use. Contractor shall make arrangements and pay for any additional parking required off Project site.

F. Deliveries and Removals: All deliveries of construction material, equipment, supplies, and similar operations, and removals shall be performed only in areas designated and approved by ODR.

G. Circulation: Confine construction operations to designated areas avoiding any interruption of vehicular circulation to existing facilities. Should these requirements become unavoidable, submit a request to ODR in writing at least two weeks prior to anticipated interruption, stating predicted time, location and duration of interruption.

H. Construction Scheduling: The Work shall be conducted in such a way as to cause a minimum of interference with the use of adjacent existing facilities during regular school and/or work hours.

I. Noise Control: The Contractor shall execute the Work in this Contract as quietly as practical to avoid unnecessary disturbances.
   1. Any complaints duly registered by Owner of unacceptable noise levels shall be cause for use of special precautions and methods of operation by Contractor to reduce noises to acceptable levels at no additional cost to the Owner.
   2. The ODR shall be sole judge of tolerability of noise levels.

J. Dust Control: Control all dust, to Owner's satisfaction, in working area and involved portions of the Project Site including access roads or drives.
PART 2 – PRODUCTS
NOT USED

PART 3 – PRODUCTS
NOT USED

END OF SECTION
SECTION 01 31 20

DRAWINGS AND SPECIFICATIONS

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and other Division 1 Sections, govern work under this Section whether attached hereto or not.

1.02 SCOPE

A. Indications on the drawings or in any section of the specifications or article or material, operation or method, requires that the Contractor shall provide each item or service of quality or subject to qualifications noted. The Contractor shall perform each operation prescribed according to conditions stated, providing therefore all necessary labor, equipment and incidentals to complete the work.

B. Drawings and specifications do not indicate or describe all the work required to complete the project. Additional details required for the complete and correct installation of selected products are to be provided by the Contractor and coordinated with the Architect.

C. Under no circumstances shall bids be submitted or work be performed with uncertainty. Questions pertaining to work that does not appear to be sufficiently detailed or explained, or pertaining to the true meaning of any part of the Drawings or Specifications shall be referred to the Architect for clarifications. After execution of the contract, no allowances will be made in favor of the Contractor for failing to check dimensions and methods of construction on the drawings and at the site and reporting any discrepancies to the Architect.

1.03 ORGANIZATION

A. The drawings and specifications have been organized by the use of cross references. Where references are shown on either the drawings or these specifications, they shall not be construed as complete. Also, the specifications are organized in sections as indicated, but such separations shall not be considered as the limits of the work required of any separate trade. The terms and conditions of such limitations are wholly between the Contractor and his Subcontractors.

1.04 WORDING OF SPECIFICATIONS

A. In order to emphasize the technical provisions and to obtain brevity, the phrases "The Contractor shall furnish all labor and materials, etc.", have at times been omitted from these specifications. Where the word "provide" appears, interpret it to mean "furnish"
all labor, materials and equipment necessary for a completed installation". Where "you" is inferred, as for example, "set in place this item", the inferred "you" means "the Contractor (or Subcontractor) shall".

B. All references to standard specifications or manufacturer's installation specifications or recommendations shall mean the latest edition or revision thereof. The words "approved", or "as approved", "for approval", "in an approved manner", "satisfactory", and like words and phrases shall be interpreted to mean the Architect's approval in writing.

1.05 CORRELATION OF DRAWINGS AND SPECIFICATIONS

A. Generally, the drawings indicate dimensions, positions, and kinds of materials and methods of construction while the Specifications indicate quality and application of materials. Work indicated on the drawings and not mentioned in the specifications, or vice versa, shall be furnished as though fully set forth in both. Work not particularly detailed, marked or specified shall be the same as similar work that is detailed marked or specified; refer Article 1.2 of the General Conditions.

1.06 ERRORS

A. Should an error appear in the Drawings or Specifications, or in the work done by others affecting this work, the Contractor shall notify the Architect at once and the Architect will issue instructions as to procedure. If the Contractor proceeds with the work so affected without instructions from the Architect, he (the Contractor) shall make good any resulting damage or defects. This includes typographical errors in the specifications and notational errors in the Drawings where doubtful of interpretation.

1.07 CONTRACTOR

A. The Contractor is fully obligated to the Owner for all work performed by Subcontractors and also for the validity and performance by Subcontractors and also for the validity and performance of each guarantee and each warranty required by these specifications.

1.08 WORK PERFORMED BY OTHERS

A. The General Contractor is responsible for coordination of all work performed by others in connection with this project.

END OF SECTION
PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. General Project Meeting Information.
B. Pre-Construction Meeting.
C. Progress Meetings.
D. Pre-Installation Meetings.
E. Lockset Hardware/Key Conference.

1.02 RELATED SECTIONS:

A. Section 01 10 00 - Summary of Work.
B. Section 01 25 00 - Substitutions Procedures
C. Section 01 32 00 - Construction Progress Documentation
D. Section 01 33 00 - Submittal Procedures
E. Section 01 34 00 - Shop Drawings, Product Data and Samples
F. Section 01 60 00 - Product Requirements.
G. Section 01 73 50 - Cutting and Patching.
H. Section 01 77 00 - Closeout Procedures.

1.03 GENERAL:

A. Contractors, Subcontractors and suppliers representatives attending the meetings/conferences of this section shall be qualified and authorized to act on behalf of the entity each represents.

B. Contractor shall comply with the following meeting requirements during performance of the Contract.
1. Arrangements: Arrange for a convenient, comfortable room in which to conduct the progress meetings, furnished as necessary to accommodate the people involved and to accomplish the purpose of the meeting. Owner will provide the room for the pre-construction meeting.
2. Notices: Distribute notices to all concerned at least seven (7) days in advance of the meeting date.
3. Records: Minutes of all project meetings shall be kept in eBuilder and available to all concerned within four (4) days after the adjournment of the meeting.
4. Schedule Updating: Immediately following each progress meeting, where revisions to the Work Progress Schedule (WPS) have been made or recognized, revise the progress schedule. Reissue revised colored copies of the WPS concurrently with minutes of each meeting.

1.04 PRE-CONSTRUCTION CONFERENCE (see UGSC):

A. Chairman: The meeting will be presided over by the ODR.

B. Attendance: The following persons will be expected to attend:
   1. Owner's Representatives.
      Project Manager
      User Coordinator.
   3. A/E's Consultants for Mechanical, Electrical and Structural Engineering.
   4. A/E’s special consultants as maybe required.
   5. Contractor’s General Superintendent and Project Manager.
   6. Major Subcontractors including at least those for mechanical, plumbing and electrical work.

C. Agenda: Subjects shall include, but are not limited to the following:
   1. Distribution of submittals. Refer to Sections 01 33 00 & 01 34 00.
   2. Sequence of critical work.
   3. Relation and coordination by the Contractor.
   4. Designation of responsible personnel.
   5. Processing of Change Orders.
   6. Distribution of Construction Documents.
   7. Access to Work to permit inspection.
   8. Maintaining project Record Documents.
   9. Use of the premises, access to the Site, office and storage areas, and Owner's requirements.
   10. Major equipment deliveries and priorities.
   11. Safety and first aid procedure.
   13. Housekeeping procedures.
   14. Additional subjects as requested by the Owner, the Architect/Engineer or the Contractor.
   15. List of major Subcontractors and suppliers.

1.05 PROGRESS MEETINGS:

A. Chairman: Contractor's Project Manager or Project Superintendent shall preside over the meeting, prepare agenda and record minutes in eBuilder.

B. Attendance: The following persons will be expected to attend:
   1. Owner's Representatives.
      Project Manager
      User Coordinator.
   3. Architect/Engineer's Consultants for mechanical, electrical and structural engineering until excused from attendance.
4. A/E’s special consultants as maybe required.
5. Contractor's General Superintendent, Project Superintendent and Project Manager.
6. Subcontractors who have work in progress.
7. Subcontractor who will start work within the next month.
8. Others as requested by ODR, A/E, or Contractor.

C. Agenda: The Contractor will provide a written agenda including but not necessarily limited to the following items:
   1. Present a brief written narrative of construction progress since the last monthly meeting containing:
      a. General description of work performed.
      b. Expectation of meeting scheduled dates.
      c. Description of current or anticipated delaying factors or problems, if any.
   2. Review the updated WPS and present a written schedule analysis.
   3. Review the Submittal Schedule/Log.
   4. Review the COR Log.
   5. Review of Requests for Information.
   6. Review of project Record Documents.
   7. Review/approval of the Progress Payment.
   8. General discussion: Other outstanding/current business.

D. Review of Pre-Installation Meetings

E. Number of Meetings: A minimum of one progress meeting shall be held each month. Other weekly or biweekly progress meetings shall be held as determined by the ODR and shall cover those subjects as required by the ODR.

1.06 PRE-INSTALLATION MEETINGS:

    A. Provide a list of all pre-installation meetings anticipated.
    B. Convene a pre-installation meeting at the Project field office prior to commencing any work.
    C. Require attendance of entities directly affecting, or affected by, work of Section.
    D. Notify A/E and ODR ten (10) days in advance of meeting date.
    E. Contractor shall prepare agenda, preside at meeting and record minutes in eBuilder.
    F. Review conditions of installation, preparation and installation procedures, and coordination with related work. Review submittals for all Work to be installed.
    G. The Contractor shall maintain an adequate inspection system and perform such inspection to insure that the work called for by this contract conforms to the contract specifications and requirements.
    H. The Contractor shall maintain complete inspection records and make them available to the ODR.
    I. Subcontractor foreman or project manager are required to attend this meeting.
1.07 LOCKSET HARDWARE/KEY CONFERENCE:

A key conference shall be conducted after approval of hardware submittal prior to the ordering of lock hardware. The Contractor shall, in conjunction with the ODR, A/E and User Coordinator, establish a date for the key conference to be held. A key conference is required to review the function of the locks and to insure that all security requirements of the Using Agency will be met.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION
SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Work Progress Schedule (WPS).
B. Daily reports.

1.02 RELATED SECTIONS:

A. Section 01 10 00 - Summary of Work.
B. Section 01 31 00 - Project Management and Coordination.
C. Section 01 33 00 - Submittal Procedures.
D. Section 01 33 50 - Shop Drawings, Product Data and Samples.
E. Section 01 77 00 - Closeout Procedures.

1.03 WORK PROGRESS SCHEDULE:

Coordination: Comply with Uniform General and Supplementary Conditions (UGSC). Coordinate both the listing and timing of reports and other activities required by provisions of this Section and other Sections, so as to provide consistency and logical coordination between the reports. Maintain coordination and correlation between separate reports by updating at monthly or shorter time intervals. Make appropriate distribution of each report and updated report to all parties involved in the Work including the A/E and the Owner. In particular, provide close coordination of the WPS, contract price breakdown, listing of subcontracts, schedule of submittals, progress reports, and payment requests.

A. Initial Work Progress Schedule: Submit a bar-chart type progress schedule within ten (10) calendar days after receipt of Notice to Proceed or Commitment Approval Work Order (CAWO). On this schedule, indicate a time bar for each major category or unit of work to be performed at the Site, properly sequenced and coordinated with other elements of work. Show completion of the activity sufficiently in advance of the date established for completion of the Work. Under no circumstances will construction operations begin other than initial mobilization until the preliminary Work Progress Schedule is submitted.

B. Work Progress Schedule: Within ten (10) calendar days after the receipt of the Notice to Proceed or Commitment Approval Work Order (CAWO), submit a comprehensive Work Progress Schedule (WPS). This schedule shall address and include all comments received from the ODR and the A/E that were in reference to the preliminary Work Progress Schedule. Note: The Owner prefers submission of the completed Construction Schedule at the preconstruction meeting if possible, otherwise the Construction Schedule shall be submitted to the ODR not later than ten (10) calendar days after the effective date of the Notice to Proceed or Commitment Approval Work Order (CAWO).
1. **General:** The Work Progress Schedule shall be in accordance with requirements of the Uniform General and Supplementary Conditions (UGSC).

2. **Work Progress Schedule:** Based on development of the preliminary WPS and whatever updating and feedback may have occurred during project start-up, secure commitments for performing major elements of the Work. Submit a comprehensive WPS indicating, by stage-coded symbols, a time bar for each major category or unit of work to be performed at the Site; include minor elements of work which are involved in overall sequencing of the Work. Contractor shall identify all critical items, in red ink. Arrange schedule to graphically show the major sequences of Work necessary for the completion of related elements of Work. Prepare and maintain the schedule on either a sheet of sufficient size, not to exceed 11" x 17", or a series of sheets showing required data clearly for the entire Construction Time. Provide monthly updates in color (or clearly discernable gray tone shading), graphically and digitally to the ODR.

3. **Area Separations:** Arrange the WPS with separations between buildings and floors as approved by the ODR.

4. **Network Diagram:** Activities shown on the WPS shall be categorized and described as follows:
   a. Each individual construction activity.
   b. A concise description of the work.
   c. An activity duration shall not exceed 20 work days. Durations of greater than 20 work days are acceptable for non-construction activities or as required by the type of construction activity.
   d. Each activity shall be coded with an activity code or hammock that relates that activity to an item on the Schedule of Values.
   e. Each activity shall be coded with an activity code that relates that activity to a phase or building. This subdivision of the Project shall be mutually agreed upon between the ODR and the Contractor.
   f. Items requiring fabrication and delivery longer than 180 days.
   g. Times anticipated for shutdown and tying-in to existing services.
   Note: This does not serve as an official request to the ODR and each individual request for an outage shall be submitted in writing fourteen (14) calendar days prior to the anticipated outage, as described in Section 01 31 00 Project Management and Coordination. An integrated schedule containing all of the above categories, or individual schedules for each of the above categories, or both, shall be as required by the A/E and/or the ODR.
   h. After Substantial Completion the Contractor shall show the following activities as a minimum:
      1. Completion of pre-final punchlist.
      2. Final inspection.
      3. The above activities are to be Finish to Start.
   i. The WPS shall show the following Major Milestone Target Finish Dates:
      1. Completion of main structure foundation piers or footings.
      2. First or ground floor slab complete.
      3. Structure top out.
      4. Building dry-in or enclosed. This is defined as the roof, exterior walls, exterior windows and openings closed in.
5. Start of conditioned air. This is defined as the building is ready to hold environmental conditions.
6. Any Early Occupancy required by the Contract.
7. Project phases as outlined in the Construction Documents.
8. Permanent Power Required
9. Other milestones as appropriate to the Project.

j. Application of Major Milestones Requirement:
   1. The Major Milestone Target Finish Dates identified above are to allow for periodic assessment of critical points of delivery in the construction process. If the Work progresses behind the WPS to the extent that a Major Milestone Target is missed, the ODR may retain sufficient funds, otherwise due to the Contractor, to provide for the assessment of Liquidated Damages in the event that the lost time is not regained. There will be no such additional retainage of funds, provided the published Major Milestone Target Finish Dates are maintained throughout the life of the project.
   2. In the event that a Major Milestone Target Finish Date has not been met according to the approved schedule, then an assessment equal to the number of days beyond the scheduled date, multiplied by the contractual liquidated damage amount will be withheld as additional retainage (see UGSC) from the current progress payment. The Contractor shall consider this action by the ODR as Notice under UGSC and shall increase the rate of Work placement accordingly.
   3. Contractor is expected to implement a recovery action plan that re-establishes the original project progress schedule within thirty (30) calendar days of the missed milestone target date.
   4. Actions taken that restore the progress schedule within this 30 day work cycle will entitle the Contractor to recover the assessed additional retainage amount for that occurrence.
   5. Beyond thirty (30) calendar days, no reimbursement will be made and a deductive Change Order will be issued.
   6. All costs to recover lost time will be borne solely by the contractor.

k. The WPS shall also show as a minimum the following activities:
   1. Permanent power energized.
   2. Required inspections such as: above ceiling inspections, wall inspections and pre-final inspections.
   3. Sufficient time to correct the items listed in the above inspections.
   4. Chilled and heating water required.

l. Each activity shall be represented by a graphical horizontal line, as follows:
   1. Each line clearly and briefly described.
   2. Estimated duration.
   3. Early start, late start, early finish, late finish, actual start and actual finish.
   4. Each activity shall have its own number.
   5. Each activity, except for start and finish activities shall have at
least one preceding and succeeding activity and each may have more than one.

6. Line shall be drawn to the length as dictated by the item scale to indicate the activity's duration including both target duration and percent complete to date.

7. Each activity shall be placed at its proper calendar location as determined by the time scale.

8. Float shall be shown in its proper time scale for all activities. Float on specific activities shall be defined as the late finish date minus the early finish date. Total Float shall be the Contract Time less the duration of the critical path, or the amount of time non-critical activities can be delayed without causing the Contract Time to be exceeded.

9. The path of critical activities shall be illustrated or accented in red, thereby easily distinguished from non-critical activities. There should only be one defined critical path.

10. Milestones or intermediate completion dates shall be clearly shown.

11. Substantial Completion Date on the WPS shall coincide with time of completion indicated in the Contract Documents.

12. The duration of each activity shall be shown in work days and include anticipated days lost due to inclement weather based on the Rainfall Table in the Supplemental General Conditions.

13. Upon review and acceptance of the WPS by the A/E and the ODR, the target bars shall be locked showing comparison between anticipated schedule and actual schedule.

14. The original schedule shall be saved as the baseline schedule and each monthly update shall be saved as a different name or version.

5. Submittals: Submit two (2) copies each of the bar chart and two (2) copies each of the computer generated reports to the A/E and to the ODR. Also submit a digital copy of the WPS to the ODR. The ODR and A/E will request revisions, if necessary, and return to the Contractor.

6. Distribution: Following the initial submittal to and response by the A/E and ODR, print and distribute WPS to A/E, ODR, the principal subcontractors, suppliers or fabricators, and others with a need-to-know schedule-compliance requirement. Post copies in the project meeting room and temporary field office. When revisions are made, distribute updated issues to the same entities and post updated issues in the same locations. Delete entities from distribution when they have completed their assigned Work and are no longer involved in performance of scheduled Work.

   a. As major revisions are made during construction, distribute current issues to the same entities listed above and make postings accordingly.

7. Reports: Computer generated printouts with data regarding each activity shown on the schedule shall include the following:

   a. Description of the activity.
b. Activity number.
c. Duration.
d. Early start, late start, early finish, late finish, actual start and actual finish dates.
e. Float.
f. Show dates as calendar dates.
g. Target start and target finish dates.

8. Report format shall be sorted in accordance with following format with “a” being the highest priority:
   a. List of activities in ascending order according to activity number.
   b. List of activities by amount of total float with activities having lowest float listed first, followed by activities with next lowest float.
   c. List activities by early start date.

9. Submit two (2) color copies each of the updated WPS to the ODR and the A/E and an electronic copy (current/active version) to the ODR at the Monthly Progress Meeting each month, illustrating the following:
   a. Show progress on all active items.
   b. Show actual completed Work as contrasted to estimated Work (i.e. target bar schedule).
   c. Show critical path activities marked to distinguish them from non-critical path activities.
   d. Show target bars from the baseline schedule.

10. Submit a detailed, written analysis describing deviations from the previous month's schedule as follows:
    a. Description of the critical path with changes from the previous month.
    b. Changes in the network diagram and logic from the previous month.
    c. Addition/deletion of activities.
    d. Activities not finishing on the late finish date, the reason for the delay, the impact on the project and corrections to the project timeline.
    e. Activities impacting meeting the Contract completion date and the reason and the corrective measures taken to correct the situation.
    f. Any other items deviating from or impacting the WPS in relation to the previous month's WPS which would have an adverse effect on the Project.
    g. Change Orders causing modifications in the Work which affect the duration, start or finish date of activities to the extent that the critical path is changed.

Note: Each of the above items shall be addressed monthly in this report.

11. Revisions to the schedule, including those created by Change Orders, shall be made at no cost to the Owner.
12. Time Extensions: Contract time extensions will not be granted unless a Change Order causes either of the following:
   
a. An increase in the duration of the Critical Path.

b. The available float of a non-critical activity is consumed causing the activity to become critical and thereby altering the critical path.

13. Time extensions shall be limited to the duration of the revised critical path less the Contract Time.

14. Project Summary Schedule: A summary project bar chart schedule shall be submitted monthly. The summary activities will match the construction items found on the Schedule Of Values. The recommended method of producing this schedule is through the use of hammock activities. All of the underlying construction activities should be linked to a hammock activity and the scheduled value for that item should be loaded onto the hammock activity. The monthly submittal of this schedule should include the originally submitted schedule as a target schedule and the current status of that activity. In addition a cost weighted plan versus actual overall project progress curve should be submitted. Immediately after the WPS has been accepted by the ODR a projected cash flow chart shall also be developed from this target schedule and transmitted to the ODR. This cash flow chart shall show graphically projected total billings versus actual total billings. This chart shall be updated monthly and submitted along with the Payment Application. It is a requirement for approval of the Payment Application.

1.04 DAILY REPORTS:

A. Prepare a daily report, recording the following information concerning events at the Site; and submit in eBuilder:
   
1. List of Subcontractors at the Site with a brief description of the work being performed.

2. Approximate count of personnel at the Site.

3. High/low temperatures, general weather conditions.

4. Accidents (refer to accident reports).

5. Meetings and significant decisions.

6. Unusual events (refer to special reports).

7. Stoppages, delays, shortages, losses.

8. Meter readings and similar recordings, as required.


10. Orders/requests by governing authorities.

11. Visitors.

12. Services connected, disconnected.

13. Equipment or system test and/or start-ups.

14. Partial completions, occupancies.

15. Status of long lead items that affect the critical path.
PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION
SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. General submittal information.
B. List of proposed Subcontractors and suppliers.
C. List of proposed materials.
D. Schedule of Values (SOV).

1.02 RELATED SECTIONS:

A. Section 01 10 00 - Summary of Work.
B. Section 01 25 00 - Substitution Procedures.
C. Section 01 32 00 - Construction Progress Documentation.
D. Section 01 34 00 - Shop Drawings, Product Data, and Samples.
E. Section 01 60 00 - Product Requirements.
F. Section 01 77 00 - Closeout Procedures.
G. All Divisions of Facility Services Subgroup - Additional submittal requirements

1.03 GENERAL REQUIREMENTS (see UGSC):

A. General: Prepare a complete schedule of work-related submittals. Submit this submittal in eBuilder within twenty-one (21) days after the effective date of the Notice to Proceed with construction (per UGSC). Correlate this submittal schedule with the listing of subcontractors and with the "list of materials" as specified in the Contract Documents.

B. Form: Prepare the submittal schedule in chronological order of submittals. Show category of the submittal, name of Subcontractor, a generic description of work covered, related section numbers, activity or event number on WPS, the scheduled date for the first submission, resubmittal, and the final release or approval by A/E. There should be sufficient time allowed for the approval process, including resubmittals, between the submission time and the required approval. The Contractor should typically follow the critical timing of these submittals in accordance with the WPS.

C. Delivery: Submittals shall be logged into eBuilder.

D. Approval: When approval is required, if resubmittals are necessary they shall be made in the manner described for the original submission, unless specified otherwise.
1.04 LIST OF PROPOSED SUBCONTRACTORS AND SUPPLIERS:

A. General: Not later than thirty (30) days after award of Contract, submit the names of Subcontractors and material suppliers tabulated by each portion of the Work, in addition to the requirements set forth in the UGSC. Performance or non-performance of any Subcontractor or material supplier will not relieve the Contractor of its responsibility for Work as called for in the Contract Documents.

1.05 LIST OF PROPOSED MATERIALS:

A. Submit list of materials within forty-five (45) days after issuance of Notice to Proceed in accordance with the UGSC.

B. Materials List: Submit a list of the following types of materials proposed for installation:
   1. Material(s) not specified. (Refer to Section 01 25 00, Substitution Procedures).
   2. Material(s) selected from a Specification naming more than one manufacturer or supplier.
   3. Material(s) selected to conform to a reference specification when no manufacturer has been named.

C. It will be assumed that materials omitted from the list will be furnished as specified when only one manufacturer has been specified. When more than one manufacturer has been named or when reference specifications have been used the A/E's selection will govern.

D. The list shall be complete and tabulated by, each Specification section and/or portion of the Work. Include name of manufacturer of each material. For materials specified by reference standards, also include the following with the listing of each such product:
   1. Address of manufacturer.
   2. Trade name.
   3. Model or catalogue designation.
   4. Manufacturer's data, including performance and test data and referenced standards.

1.06 SCHEDULE OF VALUES (see UGSC):

A. General:
   1. Submit a Schedule of Values (SOV) in sufficient time to allow review and approval by the ODR and A/E prior to submitting first Application for Payment. (Refer to UGSC)
   2. Upon request by A/E or ODR, furnish additional data to support SOV values given that will substantiate their correctness.
   3. Approved SOV will be used as basis for reviewing Contractor's Applications for Payment.
   4. No payment will be made to the Contractor until the ODR and the A/E have approved the SOV.

B. Form and Content:
   1. Use the Owners componentization categories (delivered at the preconstruction meeting) for preparing the SOV.
   2. List installed value of component parts of Work in sufficient detail to serve as basis for computing values for progress payments.
3. Line item costs shall not include General Contractor fee/overhead and profit; but, shall reflect the direct cost for labor and materials to General Contractor.

4. Separate line item cost for each of the following General Contractor cost items:
   a. Bonds.
   b. Field supervision and layout.
   c. Temporary facilities and controls.
   d. General Contractor overhead and profit.

5. Separate items into labor amounts and material amounts for each item.
   a. Labor Costs: Estimated installation costs including labor, applicable taxes, insurance, fringe benefits, erection equipment and tools.
   b. Materials Costs: Include estimated material and manufactured equipment costs including delivery, taxes and insurance.

6. Combined total of all costs listed in SOV shall equal Contract Sum.

C. Review and Resubmittal:
   1. After initial review by ODR and A/E, revise and resubmit as required.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION
SECTION 01 34 00
SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. General submittal information.

B. Architect’s and Engineer’s action.

C. Shop drawings, product data and samples.

D. Field mock-ups and field samples

E. Color schedules

F. Required submittals.

1.02 RELATED SECTIONS:

A. Section 01 10 00 - Summary of Work.

B. Section 01 25 00 - Substitution Procedures

C. Section 01 31 00 - Project Management and Coordination.

D. Section 01 32 00 - Construction Progress Documentation.

E. Section 01 33 00 - Submittal Procedures.

F. Section 01 60 00 - Product Requirements.

G. Section 01 77 00 - Closeout Procedures.

H. Other Technical Sections: Additional submittal requirements.

1.03 SUBMITTALS, GENERAL:

A. In addition to the requirements outlined in the Uniform General and Supplementary Conditions, Contractor shall comply with the following duties and responsibilities.

B. The Contractor shall submit to the A/E for review all shop drawings, product data, samples and other submittals for all items required in the Technical Sections of the Specifications and for all items proposed for use in the Work. Do not combine submittals for specified work with requests for substitutions. Submit requests for substitutions in accordance with Section 01 25 00. The Contractor will also submit one (1) complete set of review shop drawings, product data, samples and other submittals for all items proposed for use in the Work in eBuilder “For Review Only”.

Shop Drawings, Product Data and Samples
Page 01 34 00 - 1 of 10
C. The Contractor shall review and stamp approval and submit, with reasonable promptness and in orderly sequence, all shop drawings, product data and samples required.

D. Submit shop drawings, product data and samples far enough in advance to allow ample time for A/E’s review, resubmittal if required, and fabrication without creating any delay in the Work, or the work of any other contractor or subcontractor.
1. Make architectural submittals a minimum of thirty (30) days prior to needed return date.
2. Make structural, mechanical and electrical submittals a minimum of thirty (30) days prior to needed return date.
3. Allow more review time for requests of substitutions.
4. Shop drawings will be submitted via eBuilder.
5. The A/E, after review and approval of submittals, will place submittal in an Approved Submittal folder in eBuilder Docs/07 Construction/Submittals/Approved Submittals.
6. The use of eBuilder submittals will be discussed at the Pre-Construction Conference.

E. Submittal Content Requirements:
1. Shop drawings shall be completely detailed and dimensioned with types, sizes, and gauges of materials noted. Where shop coat of paint is required on materials, brand name, and chemical content shall be noted on the drawings.
2. Shop drawings shall be neatly, accurately, and legibly drawn, noted and referenced.
3. Each item contained in the submittal shall be clearly referenced and noted establishing the item’s location in the finished work.
4. Member and item designations shall be the same as those used on the A/E’s drawings, except that, where the A/E’s has used the same designation for more than one member or item, the Contractor may add a suffix to the designation to differentiate between these members.
5. Where published standard exist (such as ACI Standard 315-99 Details and Detailing of Concrete Reinforcement), these shall be followed in the preparation of shop drawings. Where no such standards are published by the industry or trade concerned, the shop drawings shall be prepared in a suitable form acceptable to the A/E.

F. Submittal Format Requirements:
1. Submittal Preparation: Mark each submittal with a permanent label or title block, as appropriate, for identification with the following information on the label or title block for proper processing and recording of action taken.
   a. Title of submittal and date submitted.
   b. Sheet number and number of sheets included (as applicable). Number drawings consecutively.
   c. Project Name, Project Number, and location of Project.
   d. Name of Architect and Architect's Project Number.
   e. Name of Contractor, subcontractor, fabricator supplier, and manufacturer, as appropriate.
   f. Name of drawing and scale (as applicable).
   g. Name and date of each revision.
   h. Cross reference to A/E's Drawings and Specification Sections, as appropriate.
i. Provide a space on the label or adjacent to title block for the Contractor's review and approval markings, and appropriate space for the Architect's or Engineer's "Action" stamp.

j. Name of each item on each sheet submitted and indicate its location in the Project Work.

2. Submittal Numbering System: To expedite review of shop drawings, product data, samples and other submittals, all submittals shall be assigned a submittal number clearly visible on all transmittal forms and on each copy of each submittal adjacent to Contractor's review stamp. Numbering system shall track Specifications format. In the example 03 30 00-001.0, the number represents the following:
   a. First Six Numbers: Specification Section; Section 03 00 00 in example.
   b. Seventh Through Ninth Numbers: Numerical log of submittals within each Division; Submittal number 001 in example.
   c. Last Number: Initial or re-submittal of each submittal; .0 for initial submittal, .1 for first re-submittal, and so forth.

3. Transmittal Form: Provide a letter of transmittal with each submittal, in duplicate, accurately describing the complete contents of the submittal, including the following:
   a. Project name.
   b. Date.
   c. To:
   d. From:
   e. Names of subcontractor, manufacturer and supplier.
   f. References.
   g. Category and type of submittal.
   h. Submittal purpose and description of number of sheets, type of data, equipment and product types, finishes, submittal number, and similar data.
   i. Submittal and transmittal distribution record.
   j. Signature of transmitter.
   k. Record relevant information and requests for data on the transmittal form. On the transmittal form, or on a separate sheet attached to the form, record deviations from the requirements of the Contract Documents, if any, including minor variations and limitations.

4. Submit Plumbing, Mechanical and Electrical items specified in each individual Section at the same time. Partial submittals will not be considered.

5. Bind each of the Plumbing, Mechanical and Electrical submittals into a single file; individual submittals will not be accepted. Each complete brochure shall contain a Table of Contents showing the order in which the items are arranged in the file. Arrange items in the same order in each file. Where manufacturer's literature contains information on more than one product, clearly mark the item being submitted, using the symbol or designation used to identify the item on the Drawings or in the Specifications.

6. Group only like or related items together in a single submittal. Do not combine submittals for specified work with requests for substitutions. Submit requests for substitutions as specified in Section 01 25 00.

G. Contractor Duties and Responsibilities:
   1. Coordinate requirements for submission of each shop drawing, product data and sample as required to properly execute the Work and as necessary to maintain satisfactory progress of the Work in accordance with the WPS and Submittal Schedule.
2. Review shop drawings, product data, and samples prior to submission to A/E. By submitting shop drawings, product data, and samples, Contractor represents that it has verified field measurements, field construction criteria, catalog numbers and similar data, and has coordinated each submittal with requirements of the Work and of the Contract Documents. Contractor's responsibility for errors and omissions in submittals is not relieved by A/E's review of submittals. Submittals received from sources other than Contractor will be returned to sender without A/E's review "action".

3. Contractor shall certify by stamped, signed, and dated notation on each submittal, that "Submittal is in compliance with requirements of Contract Documents without deviation." Submittals without Contractors stamp and submittals which, in A/E's or ODR's opinion, are incomplete, contain numerous errors, have not been checked, or have been checked only superficially, will be returned without disposition. Delays resulting there from shall be Contractor's responsibility.

4. Contractor shall not be relieved of responsibility for any deviation from the requirements of the Contract Documents by A/E's review of shop drawings, product data, and samples unless Contractor has specifically informed the A/E in writing of such deviation at time of submission and A/E has given written acceptance to the specific deviation.

5. Contractor shall direct specific attention, in writing or on resubmitted shop drawings, product data or samples, to revisions other than those requested by A/E on previous submittals.

6. Contractor shall give prompt written notice to A/E of inability to comply with exceptions noted on the returned submittals or if unsatisfactory results are anticipated. Document specific reasons for inability to comply or specific unsatisfactory results that are anticipated. Propose substitution to comply with intent of the Contract Documents and produce satisfactory results in accordance with the substitution requirements of Section 01 25 00.

7. No portion of the Work requiring submission of a shop drawing, product data or sample shall be commenced until submittal has been reviewed with "No Exceptions Taken" status by A/E, except as otherwise provided in this Section.

8. All portions of the Work shall be in accordance with approved submittals.

H. Submittal Quantity: The Contractor shall furnish Shop Drawings submittals in eBuilder. Submit minimum of three samples of materials requiring choice of color, texture or finish. Large job site samples shall be limited to one for each approval submittal.

I. Reproduction and Distribution of Submittals After A/E's Review: A/E shall move Approved Submittals to a folder in eBuilder labeled Approved Submittals. Retain job site mock-ups and samples until removal is approved by A/E and ODR.

J. There will be no payment made for submittal preparation.

1.04 ARCHITECT'S AND ENGINEER'S ACTION (UGSC):

A. Upon receipt of submittals requiring review, the A/E will review submittals and return them to the Contractor with results of the review indicated as follows:

1. REVIEWED; NO EXCEPTIONS TAKEN: Submittal has been reviewed for the limited purpose of checking for conformance information given and design concept expressed in the Contract Documents and no exceptions are taken; Contractor may
1.05 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES (UGSC):

A. Shop Drawings: Comply with "Submittals, General" and the following:

1. Definition: The term Shop Drawings refers to original drawings prepared by the Contractor, Subcontractor, supplier, fabricator or distributor illustrating a portion of the Work including fabrication drawings, manufacturing drawings, erection drawings, setting drawings, patterns, coordination drawings, schedules, design mix formulas, Contractor's engineering calculations, and layout drawings including ceiling layouts if different from the Contract Documents. Do not submit Contract Documents for Shop Drawings.

2. Format: Prepare drawings on minimum 8-1/2" x 11" to maximum 30" x 42" sheets. Draw plan and section details at a scale of 1" = 1' - 0", details shall be drawn at a scale of 3" = 1' - 0" or larger scale. In addition to "Submittals, General" requirements, each drawing shall be cross-referenced to A/E's Drawings.

3. Content: Shop Drawings shall include, but not be limited to the following:
   a. The size thickness of members.
   b. The method of anchoring and securing parts.
   c. The quantity and location of each item.
   d. Other pertinent data necessary to show the work to be done, where, and how it is to be done.
   e. Materials and finishes.
   f. How item fits to abutting work and requirements for related construction.
   g. Required connections.
   h. Overall size and weight.
   i. Clearances and tolerances.
   j. Verification of field conditions prior to fabrication.
   k. Coordination of Shop Drawings and data with requirements for related construction.
   l. Refer to Section 01 31 00 - Project Management and Coordination for other requirements.
B. Product Data:
1. Definition: Manufacturer's standard product specifications, installation instructions, rough-in diagrams and templates, standard wiring diagrams, printed performance and operational range diagrams, mill reports, operating and maintenance manuals, color charts, data sheets, brochures, drawings and diagrams, and other standard illustrative and descriptive data to clearly identify pertinent data, models and materials, uses, limitations, actual dimensions and clearances required, and technical performance data including wiring diagrams and controls. **Specific item must be identified on catalog cut sheets.**
2. Mark out information not applicable to this Project and supplement standard product data to show compliance with requirements.

C. Samples:
1. Definition: Samples include:
   a. Partial sections of manufactured or fabricated work.
   b. Small cuts or containers of materials.
   c. Complete units of repetitively-used materials.
   d. Swatches showing full range of color, texture and pattern.
   e. Color range sets.
   f. Units of work to be used for independent inspection and testing.
   g. Units of work to be used as a standard to judge materials and workmanship.
2. Provide samples for items where specified and for items requiring a choice of color, texture or finish. Samples shall illustrate the materials and workmanship and establish standards by which to judge the completed work.
3. Typical office samples shall be approximately 12" square or 12" long unless otherwise noted and shall clearly illustrate the applicable function, corners, joints, related parts, attachment devices, specified finish and full range of colors. Full size approved samples may be incorporated into the Work unless otherwise noted.

1.06 FIELD MOCK-UPS AND FIELD SAMPLES (UGSC):

A. The Contractor shall erect and maintain mock-ups and field samples as required by the various sections of the specifications.

B. Field samples and job site mock-ups shall be erected at the Project Site at a mutually agreed location. Contractor shall request approval for location on which to construct mock-up of field sample prior to proceeding. Each field sample or mock-up shall be complete and illustrate the range of finish and workmanship required in the completed Work and will be used by A/E and ODR, upon approval, as a standard to judge subsequent work.

C. Where several mock-ups of alternate construction techniques or finishes are required and prepared, each shall be labeled for clear identification indicating base construction finish material, special techniques used and where important for duplication of effect line pressures, grit classification, lengths of exposure, surface preparation, undercoats, strength of reagents, etc.

D. Contractor shall request review of mock-up or field sample upon completion prior to proceeding with actual construction work.
E. Contractor shall protect mock-up or field samples from damage, inclement weather, dirt and discoloration prior to and after A/E’s and Owner’s approval. Retain on the job as a standard reference for materials, workmanship and appearance until removal is authorized. Do not alter, move or destroy mock-up or field sample until so authorized. Remove and dispose of mock-up only after approval is given by the ODR.

1.07 COLOR SCHEDULES:

A. After receipt of all samples, A/E will present to the ODR a proposed comprehensive color schedule for review and approval.
   1. Once approved, the colorboard will be sent to and kept at the job site for reference. A second set of approved colors, in a 3-ring binder, must be provided to the ODR.
   2. The Contractor must insure that required submittals for all items requiring color selection are accomplished in a timely manner. The A/E cannot prepare the colorboard for approval by the ODR until all items requiring color selection have been submitted.

B. The approved color schedule will then be released to the Contractor for ordering materials.

C. No color selection will be released until all colors are approved in the comprehensive color schedule. Any "early" selections requested, and acted upon by the Contractor, shall be at its own risk and understanding that material of color differing from the approved color schedule will be rejected.

D. If the Contractor is unable to submit all exterior color selections/samples within sixty (60) days or all interior color selections/samples within ninety (90) days after "Notice to Proceed", the A/E may proceed with preparation of the color schedule using the color selections of a specified product. The Contractor shall be required to match the selected colors at no additional cost to the Owner of the specified product selected by the A/E.

1.08 REQUIRED SUBMITTALS:

A. General:
   1. In addition to the requirements outlined in the UGSC, Special Conditions, Division 1 and in the Technical Sections of the Specifications, the Contractor shall submit shop drawings, product data, samples, color samples, warranties, and other pertinent data as briefly scheduled herein.
   2. Refer to each individual Section of the Specifications for specific requirements of each submittal item.
   3. Where requirements are not specifically indicated, provide sufficient data as required to incorporate each item into the work.
   4. All subcontractors, suppliers, and manufacturers shall provide a warranty of materials and workmanship of not less than one year duration, and as otherwise specified (see UGSC).

B. Submittal Legend: The following abbreviations are used in remarks column of the Submittals:
   1. SD: Shop Drawings
   2. M: Manufacturer's Data
3. C: Color Selection Required
4. S: Physical Samples
5. R: Additional Replacement Materials
6. MO: Maintenance and Operating Manuals
7. IO: Instruction of Owner's Personnel
8. G1, G5, Etc: Guarantee with number of years duration
9. TR: Test Reports
10. CR: Certifications

C. Submittals:

**Division 1 - General Requirements**

- List of Subcontractors: within 30 days after notification of Contract Award (per UGSC)
- List of Materials: within 45 days after issuance of Notice to Proceed (per UGSC)
- Initial WPS: within 10 days after issuance of Notice to Proceed (per UGSC)
- WPS: within 30 days after issuance of Notice to Proceed
  - General Contractor's Maintenance Warranty: G1
  - Schedule of Values: not later than 45 days after issuance of Notice to Proceed and each month thereafter (per UGSC)
  - Contract Warranty and Guarantee: additions noted herein
    - Guarantees: additions noted herein
    - Maintenance: MO 4 sets prior to Final Acceptance and payment
  - All items requiring Color Selection within 60 days Soil, Concrete Mix Designs M, S
  - Coordination Drawings: within 90 days after issuance of Notice to Proceed and 10 days prior to work taking place

**Division 2 - Existing Conditions (Not Used)**

**Division 3 – Concrete (Not Used)**

**Division 4 – Masonry (Not Used)**

**Division 5 – Metals**

- Structural Steel: M, SD, CR, TR, G1
- Miscellaneous Metals: M, CR, C, S, SD, G1

**Division 6 – Wood, Plastics and Composites**

- Rough Carpentry: M, CR, G1
- Finish Carpentry: S, SD, G1

**Division 7 - Thermal and Moisture Protection**

- Building Insulation: M, S, CR, G1
Cementitious Fireproofing M, TR, G1
Joint Sealers M, SD, S, CR, C, G5

**Division 8 - Openings**

Metal Frames M, SD, CR, G1
Wood Doors M, SD, S, C, CR, G(Life)
Access Doors M, SD, G1
Finish Hardware Schedule M, SD, S, G1/5
Glass and Glazing M, SD, S, C, G1/5 (mirrors)

**Division 9 - Finishes**

Gypsum Board Systems M, S, CR, TR, G1
Resilient Flooring M, SD, S, CR, R, C, G1
Carpeting M, SD, S, C, TR, R, G15
Painting M, SD, S, C, CR, R, G1

**Division 10 - Specialties**

Identifying Devices M, SD, S, C, G1
Fire Extinguishers and Cabinets M, SD, C, G1
Folding Partitions M, SD, S, C, G2

**Division 11 – Equipment (Not Used)**

**Division 12 – Furnishings (Not Used)**

**Division 13 - Special Construction (Not Used)**

**Division 14 - Conveying Equipment (Not Used)**

**Divisions 21 to 28 – Facility Services Subgroup**

Refer to the various Division Sections specific submittal requirements M, SD, S, C, MO, IO, G1

**Division 31 – Earthwork (Not Used)**

**Division 32 – Exterior Improvements (Not Used)**

**Division 33 – Utilities (Not Used)**

**Division 34 – Transportation (Not Used)**
PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION
SECTION 01 41 00
GENERAL REQUIREMENTS FOR RENOVATION WORK

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and other Division 1 Sections, govern work under this Section whether attached hereto or not.

1.02 GENERAL

A. This Section contains general provisions and requirements pertaining to all renovation, demolition, removal and relocation work throughout the project and becomes a part of each Section and Division performing renovation, demolition, removal and relocation work for this project with the same force and effect as if written in full therein.

B. Seal off areas in which work is in progress from the occupied portions of the building.
   1. Take all necessary measures to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level and prevent entry of dust and noise into occupied portions of the building.
   2. If temporary closures block required exits, they shall be provided with approved openings equipped with gasketed self-closing doors openable in the direction of exit, emergency lights, and exit lights as approved by the code enforcement authority having jurisdiction.

C. Furnish and maintain temporary types of protection as necessary to adequately protect and prevent accidental injury to the public, Owner's personnel and personnel employed at the work. Take all necessary precautions to keep trespassers out of work areas. Properly secure work areas from entry when work is not in progress.

D. Perform all renovation; demolition, removal and relocation work in strict accordance with Owner's instructions and applicable Federal, State and Local health and safety standards, codes and ordinances. Where conflicts occur, the more restrictive requirement shall be adhered to.

E. Construction Sequence is outlined for the contractors reference as follows:
   1. August 9 and 10, 2019 – Graduation Ceremonies
   2. August 12, 2019 – Start demolition
   3. November 29, 2019 - Substantial Completion
   4. December 13 and 14, 2019 – Graduation Ceremonies
1.03 EXISTING CONDITIONS

A. Obvious existing conditions, installations, and obstructions affecting the work shall be taken into consideration as necessary work to be done, the same as though they were completely shown or described.

B. Items of existing construction indicated to remain upon completion of the contract, but which require removal to complete the work, shall be carefully removed and replaced as required. The replaced work shall match its condition at the start of the work unless otherwise required.

C. Visit the project site to determine by inspection all existing conditions, including access to the site, the nature of structures, object and materials to be encountered, and all other facts concerning or affecting the work. Information on the Drawings showing existing conditions does not constitute a guarantee that other items may not be found or encountered.

1.04 TRADE JURISDICTION

A. Work shall conform to applicable requirements of the various technical Sections of the Specifications for this project; however, the individual Sections of the Specifications do not necessarily mention or describe in detail the trade responsibility for removal or relocation of existing construction. The Contractor shall be solely responsible for distribution of the work within the various trades involved.

1.05 NOISE PRODUCING EQUIPMENT

A. Work with noise producing equipment shall be subject, at all times, to Owner's approval of entire procedure. Coordinate removal of existing concrete and concrete related demolition (jack hammering) after business hours, on weekends and holidays.

1.06 CUTTING AND PATCHING

A. The removal and replacement of existing ceilings and the removal, cutting and patching and/or replacement of existing walls, partitions and floors as may be necessary for access to valves, piping, conduit and tubing by mechanical and electrical trades shall be included and performed as an obligation of, and as directed by the Contractor and approved by Architect.

B. The patching and/or replacement shall be performed by the appropriate subcontractor for the work involved, or by other properly qualified subcontractor or labor as recommended by the Contractor and approved by the Architect.
1.07 PROTECTION OF WORK TO REMAIN

A. Work to Remain in Place: Protect from all damage. Use barricades, tarpaulins, temporary walls, plywood, planking, masking, and other suitable means and methods as approved.

B. Accidental or Careless Damage to Work to Remain in Place: Restore to a condition as good as or better than existed before work was commenced and at no additional cost to the Owner.

1.08 PROCEDURES

A. General
1. Provide temporary hoists as required for transportation of equipment and material. Install and operate in accordance with all safety regulations.
2. Erect scaffolding as necessary to join access to the various parts of the Work. Provide structurally sound, rigidly braced and properly constructed scaffolding to support the activities of workmen and loads. Design and construction shall be in accordance with applicable safety regulations.
3. Refer to specific technical Sections for additional information regarding materials and execution of the work.

B. Renovation Procedures
1. Contractor shall be responsible for performing all remodeling work in such a manner as to preserve the aesthetic and structural integrity of existing materials and construction.
2. Check Drawings carefully and thoroughly investigate existing building construction. Furnish and install all shoring and bracing necessary to positively protect the existing elements of the building. Material used shall be adequate to support anticipated loads with a properly calculated margin of safety. Provide for transfer of stresses to successively lower construction.
3. Schedule work so as to impose a minimum of hardship on the operation of the facilities when in session and the performance of the work of other trades.
4. Provide approved temporary partitions for the protection of the existing facility, its contents and the work of this Contract against dust, weather, damage and noise. Relocate, as approved and as directed, temporary partitions from time to time as work progresses.

C. Demolition and Removals:
1. Carefully remove and store all items indicated or required to be reused.
2. Demolition: Perform demolition and removal work completely and remove debris from the site. Use such methods as required to complete the work within the limitations of governing regulations.
   a. Proceed with demolition and removal work in a systematic manner, from the top to the bottom in areas indicated.
   b. Remove debris and lower to ground by means of hoists, derricks, or other suitable methods to limit air pollution.
   c. Locate demolition equipment throughout the structure and remove materials so as to not impose excessive loads to supporting walls, floors or framing.
3. Partial Removal: Items of salvageable value to the Contractor may be removed from the structure as the work progresses. Salvaged items must be transported from the project site as they are removed. Storage or sale of removed items on the Project Site will not be permitted.

4. Traffic: Conduct demolition and removal operations and the removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

5. Protections: Ensure the safe passage of persons around areas of new construction, demolition, and removals. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.
   a. Erect temporary covered passageways as required by authorities having jurisdiction.
   b. Provide interior and exterior shoring, bracing, or support to prevent movement or settlement or collapse of structures to be demolished and adjacent facilities to remain.

6. Damages: Promptly repair damages caused to adjacent facilities by demolition and removal operations at no cost to the Owner.

7. Utility Services: Maintain existing utilities, indicated to remain, keep in service, and protect against damage during new construction, demolition, and removal operations.
   a. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to the governing authorities.

D. Cutting:
1. Concrete: Saw cut. Jack hammering with electric or pneumatic equipment is acceptable only with scheduled approval of Owner.
2. Items indicated for relocation in the new Work, or to be retained by the Owner: Carefully remove to avoid damage, thoroughly clean and reinstall as indicated, or store as directed.
3. Existing Doors and Frames: Remove in such manner as to facilitate filling in of openings or installation of new work, as required by the Drawings.
4. Structural Elements: If not specifically shown, but removal is required, perform such removal or alteration only upon written approval of the Architect. Do not damage or alter any structural element of the existing building.

E. Patching, Repairing and Finishing:
1. Matching Existing Work: Except where otherwise specifically indicated or specified as a definite change, the finish materials and appearance of the new patch work shall match the existing contiguous materials and finishes in all respects. Repairs and/or continuations of existing work shall be relatively imperceptible in the finished Work when viewed under finished lighting conditions from a distance of six (6) feet.
2. Maintaining the integrity of the existing assemblies and building components: Removal of existing utilities, ductwork and other items necessary for the completion of the work which leaves openings in required assemblies (sound, fire, pressurization or other) MUST be repaired to meet the original specification for the rated assembly.

3. Patching, Repairing and Finishing of Existing Work: Perform in compliance with the applicable requirements of the Specification Technical Section covering the work to the performed and the requirements of this Section.

4. Concrete: An approved epoxy concrete adhesive shall be used to prepare edges of existing concrete to be patched. Finish shall match existing adjoining work. Unless otherwise approved, all concrete for patching shall be 3,000 psi concrete. Reinforcing bars and dowels shall be provided where required. Where installation of concrete is impracticable, the openings shall be filled with dry packed non-shrink grout as directed.

5. Painting and Finishing:
   a. Preparation: Prepare patched areas as required for new work. Remove all extraneous materials (nails, screws, picture hangers, adhesives, mortar, etc) from existing surfaces to be refinished to provide smooth uniform surface. Existing paint to be repainted shall be washed with neutral soap or detergent, thoroughly rinsed, and sanded when dry. Remaining paint edges shall be feathered smooth with sandpaper.
   b. Painting and Finishing: Conform to the applicable provisions of Painting Section. Bare areas and patches in existing painted surfaces shall be prepared and built-up with proper primer, block filler and intermediate coats, sanded smooth and flush with adjoining surfaces. All areas scheduled to be painted and/or repainted shall be painted as specified in Painting Section of the Specifications, except the primer coat may be omitted on existing painted surfaces.

END OF SECTION
PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Reference Requirements.

B. Governing Regulations and Authorities.

C. Definitions

1.02 REFERENCE REQUIREMENTS:

A. Materials, equipment and operations specified by reference to published standards and specifications of a technical society, trade association, or other agency standard, shall comply with the requirements of the current edition of the listed document that is in effect on the issue date of the Specifications or Addendum page making reference thereto, unless otherwise specified. Make copies of referenced documents available at site, as the ODR or A/E may request.

B. No provision of a reference standard, specification, manual, or code shall change the duties and responsibilities of the Owner, the Contractor, the A/E and their consultants, their agents and employees from those duties and responsibilities set forth in the Contract Documents.

C. Acronyms for names of technical societies, associations, and agencies referenced in the Contract Documents shall be interpreted as follows:

AA Aluminum Association
900 19th St., NW, Suite 300; Washington, DC 20006;
202-862-5100
www.aluminum.org

AABC Associated Air Balance Council
1518 K Street, NW, Suite 503; Washington, DC 20005
202-737-0202
www.aabchq.com

AAMA American Architectural Manufacturers Association
1827 Walden Office Square, Ste 550; Schaumburg, IL 60173-4268
847-303-5664
www.aamanet.org
ANLA  American Nursery & Landscape Association  
1000 Vermont Ave., NW, Ste 300; Washington, DC 20005-4914  
202-789-2900  
www.anla.org

ACI  American Concrete Institute  
38800 Country Club Drive; Farmington Hills, MI, 48331;  
248-848-3700  
www.concrete.org

ACIL  American Council of Independent Laboratories  
1629 K Street, NW, Suite 400; Washington, DC 20006-1633  
202-887-5872  
www.acil.org

ADC  Air Diffusion Council  
1000 E. Woodfield Road, Suite 102; Schaumburg, IL 60173-5921  
847-706-6750  
www.flexibleduct.org

AGC  Associated General Contractors of America  
333 John Carlyle Street, Suite 200; Alexandria, VA 22314  
703-548-3118  
www.agc.org

AIA  America Institute of Architects  
1735 New York Avenue, NW; Washington DC 20006  
202-626-7300  
www.aia.org

AIC  American Institute of Constructors  
466 94th Avenue North; St. Petersburg, FL 33702  
727-578-0317  
www.aicnet.org

AISC  American Institute of Steel Construction, Inc.  
One East Wacker Drive, Suite 3100; Chicago, IL 60601-2001  
312-670-2400  
www.aisc.org

AISI  American Iron and Steel Institute  
1140 Connecticut Avenue, Suite 705; Washington, DC 20036  
202-452-7100  
www.steel.org
AMCA  Air Movement and Control Association  
30 West University Drive; Arlington Heights, IL 60004-1893  
847-394-0150  
www.amca.org

ANSI  American National Standards Institute  
1819 L. Street, NW, 6th Floor; Washington, DC 20036  
202-293-8020  
www.ansi.org

APA  American Plywood Association  
P.O. Box 11700; Tacoma, WA 98411-0700  
253-565-6600  
www.apawood.org

ARI  Air Conditioning and Refrigeration Institute  
4100 North Fairfax Drive, Suite 200; Arlington, VA 22203  
703-524-8800  
www.ari.org

ASHRAE  American Society of Heating, Refrigerating & Air Conditioning Engineers, Inc.  
1791 Tullie Circle, NE; Atlanta, GA 30329  
404-636-8400  
www.ashrae.org

ASME  American Society of Mechanical Engineers  
3 Park Avenue; New York, NY 10016  
212-591-7000  
www.asme.org

ASTM  American Society for Testing and Materials  
100 Barr Harbor Drive; West Conshohocken, PA 19428-2959  
610-832-9500  
www.astm.org

AWI  Architectural Woodwork Institute  
1952 Isaac Newton Square West; Reston, VA 20190  
703-733-0600  
www.awinet.org

AWPA  American Wood Preservers’ Association  
P.O. Box 388; Selma, Alabama 36702-0388  
www.awpa.com
FM  Factory Mutual Engineering and Research Organization
    1151 Boston-Providence Turnpike; Norwood, MA 02062-5001
    781-762-4300

FS  Federal Specification (General Services
    Administration) Specifications Unit (WFSIS)

GA  Gypsum Association
    810 First Street, NE, Suite 510; Washington, DC 20002
    202-289-5440
    www.gypsum.org

IEEE Institute of Electrical and Electronics Engineers
    445 Hoes Lane; Piscataway, NJ 08854
    732-981-0660
    www.ieee.org

IESNA Illuminating Engineering Society of North America
    120 Wall Street, Floor 17; New York, NY 10005
    212-248-5000
    www.iesna.org

IGCC Insulating Glass Certification Council
    c/o ETL Testing Labs, P.O. Box 9, Henderson Harbor, NY 13651
    315-646-2234
    www.igcc.org

ILI Indiana Limestone Institute of America
    400 Stone City Bank Building, Bedford, IN 47421
    812-275-4426
    www.iliai.com

LPI Lightning Protection Institute
    3335 N. Arlington Hts. Road, Suite E; Arlington Hts., IL 60004
    847-577-7200
    www.lightning.org

MIL Military Standardization Documents (U.S. Dept. of Defense)

MSS Manufacturers Standardization Society of the Valve and Fittings
    Industry
    127 Park Street, NE; Vienna, VA 22180-4602
    703-281-6613
    www.mss-hq.com
NAAMM  National Association of Architectural Metal Manufacturers
8 South Michigan Avenue, Suite 1000; Chicago, IL 60603
312-332-0405
www.naamm.org

NCMA  National Concrete Masonry Association
13750 Sunrise Valley Drive; Herndon, VA 20171-4662
703-713-1900
www.ncma.org

NEC  National Electric Code (by NFPA)
National Elevator Industry, Inc.
1677 County Route 64, P.O. Box 838; Salem, NY 12865-0838
518-854-3100
www.neii.org

NEMA  National Electrical Manufacturers Association
1300 North 17th Street; Rosslyn, VA 22209
703-841-3200
www.nema.org

NFPA  National Fire Protection Association
One Batterymarch Park; Quincy, MA 02269-9101
617-770-3000
www.nfpa.org

NIST  National Institute of Standards and Technology
(formerly National Bureau of Standards; U.S. Dept. of Commerce)
Gaithersburg, MD 20899-3460
301-975-6478
www.nist.gov

NPCA  National Paint and Coatings Association
1500 Rhode Island Ave., NW; Washington, DC 20005
202-462-6272
www.paint.org

NRCA  National Roofing Contractors Association
10255 W. Higgins Road, Suite 600; Rosemont, IL 60018-5607
847-299-9070
www.nrca.net

NSF  National Sanitation Foundation
P.O. Box 130140, 789 N. Dixboro Rd; Ann Arbor, MI 48113-0140
734-769-8010
www.nsf.org
NTMA  The National Terrazzo and Mosaic Association, Inc.
201 N. Maple Avenue, Suite 208; Purcelville, VA 20132
800-323-9736
www.ntma.com

NWWDA  National Wood Window and Door Association (formerly NWMA)
1400 E. Touhy Avenue #G54; Des Plaines, IL 60018
708-299-1286
www.nwwda.org

OSHA  Occupational Safety & Health Administration (U.S. Department of Labor)
Government Printing Office
200 Constitution Avenue, NW; Washington, DC 20210
www.osha.gov

PCA  Portland Cement Association
5420 Old Orchard Road; Skokie, IL 60077
847-966-6200
www.portcement.org

PCI  Precast/Prestressed Concrete Institute
209 W. Jackson Blvd, Suite 500.; Chicago, IL 60606-6938
312-786-0300
www pci org

PDI  Plumbing and Drainage Institute (c/o Saul Baker)
45 Bristol Drive; South Easton, MA 02375
800-589-8956
www pdionline org

PS  Product Standard of NBS (U.S. Department of Commerce)

RFCI  Resilient Floor Covering Institute
401 E. Jefferson Street, Suite 102; Rockville, MD 20850
301-340-8580
www.rfci.com

RIS  Redwood Inspection Service (Grading Rules)
405 Enfrente Drive, Suite 200; Novato, CA 94949
415-382-0662

SDI  Steel Deck Institute
P.O. Box 25; Fox River Grove, IL 60021
847-458-4647
www.sdi.org
<table>
<thead>
<tr>
<th>Organization</th>
<th>Address 1</th>
<th>Address 2</th>
<th>Phone</th>
<th>Website</th>
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<tr>
<td>SDI Steel Door Institute</td>
<td>30200 Detroit Road; Cleveland, OH 44145-1967</td>
<td></td>
<td>440-899-0010</td>
<td><a href="http://www.steeldoor.org">www.steeldoor.org</a></td>
</tr>
<tr>
<td>SIGMA Sealed Insulating Glass Manufacturers Association</td>
<td>401 N. Michigan Avenue, Suite 2400; Chicago, IL 60611</td>
<td></td>
<td>312-644-6610</td>
<td></td>
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<tr>
<td>SMACNA Sheet Metal &amp; Air Conditioning Contractors National Association, Inc.</td>
<td>4201 Lafayette Center Drive; Chantilly, VA 20151-1209</td>
<td></td>
<td>703-803-2980</td>
<td><a href="http://www.smacna.org">www.smacna.org</a></td>
</tr>
<tr>
<td>SPIB Southern Pine Inspection Bureau (Grading Rules)</td>
<td>4709 Scenic Highway, Pensacola, FL 32504-9094</td>
<td></td>
<td>850-434-2611</td>
<td><a href="http://www.spib.org">www.spib.org</a></td>
</tr>
<tr>
<td>SSPC The Society for Protective Coatings</td>
<td>40 24th Street, 6th Floor; Pittsburgh, PA 15222-4656</td>
<td></td>
<td>877-281-7772</td>
<td><a href="http://www.sspc.org">www.sspc.org</a></td>
</tr>
<tr>
<td>TCA Tile Council of America, Inc.</td>
<td>100 Clemson Research Blvd.; Anderson, SC 29625</td>
<td></td>
<td>864-646-8453</td>
<td><a href="http://www.tileusa.com">www.tileusa.com</a></td>
</tr>
<tr>
<td>UL Underwriter’s Laboratories</td>
<td>333 Pfingsten Road; Northbrook, IL 60062</td>
<td></td>
<td>847-272-8800</td>
<td><a href="http://www.ul.com">www.ul.com</a></td>
</tr>
<tr>
<td>WCLIB West Coast Lumber Inspection Bureau (Grading Rules)</td>
<td>P.O. Box 23145; Portland, OR 97281</td>
<td></td>
<td>503-639-0651</td>
<td><a href="http://www.wclib.com">www.wclib.com</a></td>
</tr>
</tbody>
</table>
1.03 GOVERNING REGULATIONS/AUTHORITIES:

A. The A/E has contacted the appropriate authorities having jurisdiction for the listed regulations and codes to obtain information for preparation of the Contract Documents. The Contractor may contact authorities having jurisdiction directly for information and decisions having bearing on the Work.

3. National Fire Codes, NFPA.
5. Other applicable ASHRAE Standards
11. TIA/EIA Standards.
12. Texas Commission on Environmental Quality – (SWPPP)

1.04 DEFINITIONS:

A. Require and Similar Words: As needed to complete the Work and as directed by A/E, unless stated otherwise.

B. Perform: Contractor, at its expense, shall perform operations necessary to complete the Work, including furnishing of necessary labor, tools and equipment, and further including furnishing and installing of materials indicated, specified or required to complete such performance.

C. Provide: Contractor, at its expense, shall furnish and install the Work complete in place and ready for use, including furnishing of necessary labor, materials, tools, equipment and transportation. Definitions apply same to future, present and past tenses, except word "provide" may mean "contingent upon" where such is context.

D. Other Acceptable Manufacture, Equal, Or Equal, Equivalent and Words of Similar Import: It shall be understood such words are followed by expression "in opinion of A/E" unless stated otherwise.
E. Acceptable, Acceptance or Words of Similar Import: Acceptance or similar import of A/E is intended unless stated otherwise.

F. At No Extra Cost to Owner, With No Extra Compensation to Contractor, at Contractor's Expense or Terms of Similar Import: Such terms shall be understood to mean that Contractor shall perform or provide specified products, materials or operations of the Work at no increase to Contract Sum stated in executed Contract.

G. NIC: Work which is not being performed or provided as part of Contract; term shall mean "Not In This Contract" or "Not a Part of the Work to be Performed or Provided by Contractor." "NIC" work is indicated as an aid to Contractor in scheduling the amount of time and materials necessary for completion of Contract.

H. Indicated: The term "indicated" is a cross-reference to graphics, notes or schedules on Drawings, to other paragraphs or schedules in the Specifications, and to similar means of recording requirements in Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated," it is for purpose of helping reader locate cross-reference, and no limitation of location is intended except as specifically noted.

I. Directed, Requested or Similar Words: Where not otherwise explained, terms such as "directed," "requested," "authorized," "selected," "approved," "required," "accepted," and "permitted" mean "directed by the ODR, A/E," "requested by the ODR, A/E," and similar directions by the ODR and A/E. However, no such implied meaning will be interpreted to extend Owner's and A/E's responsibility into Contractor's area of construction supervision.

J. Approve: Where used in conjunction with Owner's and A/E's response to submittals, requests, applications, inquiries, reports and claims by Contractor, the meaning of the term "approved" will be held to limitations of Owner’s and A/E's responsibilities and duties specified in General Conditions. In no case will "approval" by Owner and/or A/E be interpreted as a release of Contractor from responsibilities to fulfill requirements of Contract Documents.

PART 2 - PRODUCTS
NOT USED

PART 3 - EXECUTION
NOT USED

END OF SECTION
SECTION 01 43 00

QUALITY ASSURANCE

PART I - GENERAL

1.01 SECTION INCLUDES:

A. General Requirements and Qualifications for Owner's Quality Assurance Testing.
B. Wall Closure and Above Ceiling Inspections.
C. Pre-final Inspection.
D. Final Inspection
E. Final Acceptance
F. One Year Inspection.

1.02 RELATED SECTIONS:

A. Section 01 34 00 - Shop Drawings, Product Data, and Samples

1.03 GENERAL REQUIREMENTS FOR OWNER’S QUALITY ASSURANCE TESTING (see UGSC):

A. The Owner/Owner’s Designated Representative (ODR) will employ a testing laboratory and/or geotechnical engineering service to perform quality assurance tests and to transmit copies of test reports to Contractor. Sampling and testing that the Owner/ODR may require is specified in this section and in the various technical sections requiring quality assurance testing. Cooperate with Owner/ODR's testing laboratory personnel, provide access to the Work, to manufacturer's and fabricator's operations, furnish incidental labor and facilities, and samples for test and inspections, as specified.

1. Employment of testing laboratory to perform quality assurance tests is for benefit of Owner/ODR in confirming that performance and quality of the Work is in conformance with the Contract Documents.

2. Employment of a testing laboratory by Owner/ODR in no way relieves Contractor's obligation to perform the Work in accordance with Contract Documents.

3. Owner/ODR's testing laboratory shall not be the same as Contractor's testing laboratory used for design and certification testing unless otherwise acceptable to the A/E and Owner/ODR.
4. Where the terms "Inspector" and "Laboratory" are used, they mean and refer to an officially designated and accredited inspector of the testing laboratory engaged by the Owner/ODR.

5. The testing firm shall make all inspections and perform all tests in accordance with the rules and regulations of the building code, local authorities, the Specifications of the ASTM and these Contract Documents.

6. **Commercial Testing Laboratories**: In general, all Contracts awarded by SSC will require that testing not performed by the Contractor (i.e., hydrostatic testing of piping) or by the A/E (i.e., spot checking of air flow by the Engineer) will be performed by a commercial testing laboratory selected by the Owner/ODR. The cost of such commercial testing will be paid directly by SSC. Retesting will also be paid by the Owner/ODR, but will be reinvoked at cost to the Contractor. The number of copies of test reports will be determined for each individual project but in general will include:

   Two copies for the Contractor;
   One copy for the A/E;
   One copy for SSC; and
   One copy for the Construction Project Inspector.

   Employment of the testing laboratory is for the benefit of the Owner/ODR for confirming that performance and quality of the Work is in conformance with the Contract Documents.

7. The engagement of a testing laboratory by the Owner/ODR in no way relieves the Contractor of its responsibility, for full compliance of the Contract. The Contractor remains liable for the quality of the materials, products/equipment installed, and satisfactory work performance.

B. **Owner/ODR's quality assurance testing and sampling may include the following testing and other services to ensure Contract performance.**
   1. **Compacted Fill and Backfill**: Perform field density tests on existing subgrade at each lift.
   2. **Footing Subgrades**: Perform tests and visual comparisons of footing subgrades to verify design bearing capacities.
   3. **Asphalt Paving and Base Material.**

C. **Limits of Testing Laboratory Authority**: Laboratory is not authorized to:
   1. Approve or reject any portion of the Work.
   2. Perform any duties of the Contractor and Subcontractors.
   3. Revoke, alter, relax, expand, or release any requirement of the Contract Documents or to approve or accept any portion of the Work, except where such approval is specifically called for in the Specifications.
   4. Laboratory technicians do not act as foremen, or perform other duties for Contractor. Work will be checked as it progresses, but failure to detect any defective work or materials shall not, in any way, prevent later rejection when such defect(s) are discovered.
1.04 WALL CLOSURE/ABOVE-CEILING INSPECTIONS (see UGSC)

A. Before the installation of any ceiling or the closing of walls and chases, an inspection will be conducted to see that all items fully meet the plans and specs before being covered. Only after all the deficiencies have been corrected will the Contractor be allowed to install the ceiling or close-up the wall.

B. As a minimum, the following should be in place before an above-ceiling inspection is scheduled:
   1. All light fixtures installed and working;
   2. All plumbing installed and insulation complete;
   3. All rigid and flexible ducts installed;
   4. All required valve identification tags installed;
   5. All air devices installed and connected;
   6. All controlled air tubing installed; and
   7. The ceiling support structure installed.

C. Walls and chases will be inspected to verify the presence of blocking and bridging, and to verify electrical conduit and boxes are installed and supported properly.

D. Those in attendance at these inspections shall include the A/E (as required), selected personnel from SSC, the General Contractor, plumbing, electrical and mechanical subcontractors.

E. A minimum of fourteen (14) days notice shall be given to the ODR prior to these inspections.

1.05 A/E AND PROJECT INSPECTOR'S SUBSTANTIAL COMPLETION INSPECTION (see UGSC)

A. When the Contractor feels that the Work is complete and ready for the Owner's use, it will notify the A/E and the ODR in writing fourteen (14) days prior to the date that the Work is anticipated to be complete and ready for a Substantial Completion Inspection. The A/E, along with representatives of SSC, User Coordinator, and the University will make a detailed inspection of all Work included in the Contract and the A/E will furnish to the Contractor a list of incomplete items. When all these items have been completed by the Contractor (within 30 days), the A/E and the ODR will be notified that all items of the Substantial Completion Inspection have been completed.

1.06 FINAL INSPECTION AND ACCEPTANCE (see UGSC)

A. Upon verification by the A/E and the ODR that the deficiencies found during the Substantial Completion Inspection have been corrected, and the Work is ready for Final Inspection and Acceptance, the ODR will, within ten (10) calendar days after receiving written verification by the A/E, make a Final Inspection. When the Work is found acceptable under the Contract Documents (within 7 days) without any exceptions and the Contract is fully performed, then final payment will be made to the Contractor. Those in attendance at the Final Inspection will include the A/E, representatives of SSC, User Coordinator and Texas A&M University.
1.07 FINAL ACCEPTANCE (see UGSC)

A. When the Work is fully complete, the A/E and construction project manager will notify SSC, recommending final acceptance of the Work. SSC will prepare a Report of Final Inspection and Acceptance.

1.08 ONE YEAR INSPECTION

A. All Contracts awarded by SSC contain a one (1) year workmanship and material guarantee as stated in Uniform General and Supplementary Conditions, Articles 13.2 and 13.5. Defects which might result in damage to the facility or other property should be called to the attention of the Project Manager, SSC, who will notify the A/E and the Contractor.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

3.01 STRUCTURAL STEEL

A. Inspect all structural steel during fabrication and during and after erection for conformance with Contract Documents and Shop Drawings. Any cases of insufficient bracing or guyng, or other unsafe conditions shall be immediately called to attention of the Contractor and reported to A/E and the ODR.

B. Shop Inspection:
   1. Examination of all steel for straightness and alignment.
   2. Examination of all fabricated pieces and checking of same with erection plans and detail drawings.
   4. Ultrasonic testing of all full penetration welds.
   5. Examination of galvanizing.
   6. Examination of installation of shop welded shear studs.
   7. Examination of shop painting.

C. Field Inspection:
   1. Proper erection of all pieces.
   2. Proper installation of all bolts.
   3. Plumbness of structure and proper bracing.
   4. Proper field painting.
   5. Visual examination of all field welding.
6. Inspect all shop fabricated members, upon their arrival at the jobsite, for defects incurred during transit and handling.

D. Qualifications of Welders: Fabricator and erector shall provide the testing laboratory with names of welders to be employed to work, together with certification that each of these welders has passed qualification tests within the last year using procedures covered in the American Welding Society "Structural Welding Code - Steel," latest edition. Verify all welder qualifications.

E. Inspections of shop and field welding shall be "verification inspection," in accordance with the AWS Structural Welding Code and as follows:
1. Visually inspect the welding of all shop fabricated members and note the location of all cover plates, connectors, bearing stiffeners, splices, and fillet welds for proper return around ends and check for seams, folds and delaminations.
2. Warped or out-of-plumb connectors shall be reported prior to any further welding.
3. Ultrasonically test all penetration welds in accordance with ASTM # 164.
4. Surfaces to be welded and all filler metal shall be carefully inspected. Surface preparations, fit-up and cleanliness of surface shall be noted. Electrodes shall be checked for size, type and condition.
5. Welds shall be sound, clean metal, free of slag inclusions and porosity. Filler metal shall be completely fused with base metal and shall completely penetrate the joint. Root passes shall be checked for penetration from the back side of joint. Welds showing inclusions, porosity, lack of fusion, incomplete penetration or uneven contour (sagging or overlaps) shall be ordered gouged out and rewelded. Welds showing any undercut shall have a small stringer bead ordered to be run in along the toe of under cut using a smaller diameter electrode than that which made the original weld. No craters shall be left in welds. Any welding defects, including porosity, fusion and undercuts in excess of that allowed, shall be cause for rejection. Where craters occur, the inspector shall order them to be filled out with weld metal.
6. The inspector shall check that all welds have been marked with the welder's symbol. The inspector shall mark the welds requiring repairs and shall make a reinspection. The inspector shall maintain a written record of all welds. Work completed and inspected shall receive an identification mark by the inspector. Unacceptable material and work shall be identified by the word "reject" or "repair" marked directly on the material.
7. The testing agency shall advise the ODR and the A/E of any shop and/or field conditions which, in its opinion, may require further tests and examination by means other than those specified. Such further tests and examinations shall be performed as authorized by the ODR and the A/E.
8. The Owner/ODR reserves the right to use ultrasonic or radiographic inspection to verify the adequacy of all welds. Testing procedures and acceptance criteria shall be as specified in AWS D1.1.
F. Inspection of bolted construction shall be in accordance with AISC Specification for Structural Steel Buildings and as follows:
   1. All bolts shall be visually inspected to ensure that the plies have been brought into snug contact.

G. Inspection of stud field welding shall be in accordance with the AWS Structural Welding Code, latest edition and as follows:
   1. A minimum of two shear studs shall be welded at the start of each production period in order to determine proper generator, control unit, and stud welder setting. These studs shall be capable of being bent 45 degrees from vertical without weld failure.
   2. Visually inspect studs for compliance with contract documents. Check number, spacing, and weld quality. If, after welding, visual inspection reveals that a sound weld or a full 360 degree fillet has not been obtained for a particular stud, such stud shall be struck with a hammer and bent 15 degrees off perpendicular to the nearest end of the beam. Studs failing under this test shall be replaced.

3.02 EXPANSION BOLT INSTALLATION

A. Inspect the drilling of each hole and installation of each expansion bolt for compliance with the Contract Documents and shop drawings.

B. Verify the installation torque for each expansion bolt for compliance with manufacturer's installation instructions.

END OF SECTION
PART 1 - GENERAL

1.01 SECTION INCLUDES:
   A. General Requirements and Qualifications for Contractor's Testing Laboratory Services.
   B. Submittals.
   C. Reference Standards.

1.02 RELATED SECTIONS:
   A. Section 01 34 00 - Shop Drawings, Product Data, and Samples
      Section 01 33 00 – Submittal Procedures

1.03 GENERAL REQUIREMENTS FOR CONTRACTOR'S LABORATORY SERVICES (see UGSC):
   A. Contractor's Design and Certification Testing: Provide services of an independent testing laboratory or facility acceptable to the A/E and the ODR to perform design and certification testing services.
      1. Submit written description of testing laboratory giving qualifications of personnel, laboratory facilities and equipment, and other information as may be requested by A/E and ODR.
      2. Contractor's testing laboratory shall not be the same as Owner's testing laboratory used for quality assurance testing unless otherwise acceptable to the A/E and ODR.
   B. Contractor's design testing and certification testing includes:
      1. Earthwork: Identify suitable soil material at borrow material location, sampling soil material, and testing of soil material samples.
      2. Performing certified welding procedure qualification and requalification testing specified.
      3. Testing of materials when mill certificates are unavailable.
      4. Additional testing when source of material is changed after initial tests have been performed.
      5. Other testing required by other Sections of the Specifications.

1.04 QUALIFICATIONS:
   A. Laboratory Qualifications and Procedures:
2. The inspection and testing services of the testing firm shall be under the direction of a Registered Engineer licensed in the State of Texas and having at least five years engineering experience in inspection and testing of construction materials.

3. Inspecting personnel monitoring concrete work shall be ACI certified inspectors.

4. Submit copy of report of inspection of facilities made by Materials Reference Laboratory of National Bureau of Standards during most recent tour of inspection. Include memorandum of remedies of deficiencies reported by this inspection.

5. Testing Equipment: Calibrated at reasonable intervals by devices of accuracy traceable to National Bureau of Standards.

6. Tests and inspections shall be conducted in accordance with specified requirements and if not specified, in accordance with applicable standards of the American Society for Testing and Materials and other recognized authorities, as approved.

7. Primary inspectors performing structural steel inspection shall be currently certified AWS Certified Welding Inspectors (CWI), in accordance with the provisions of AWS QCI, "Standard and Guide for Qualification and Certification of Welding Inspectors." The inspector may be supported by assistant inspectors who may perform specific inspection functions under the supervision of the inspector. Assistant inspectors shall be currently certified ASW Certified Associate Welding Inspectors (CAWI). The work of assistant inspectors shall be regularly monitored by the inspector.

B. Laboratory Duties: Cooperate with A/E, ODR and Contractor. Upon notice, provide qualified personnel to perform required tests and inspections. In performing tests and inspections, Laboratory shall:

1. Comply with specified standards. Comply with building code requirements for "Special Inspection" whether or not such inspections are specified herein.

2. Ascertain compliance of materials with requirements of Contract Documents. If the material furnished and/or work performed fails to meet requirements of Contract Documents, laboratory inspector shall promptly notify the Contractor, A/E and the ODR of such failure.

3. Promptly notify ODR, Contractor and A/E of observed irregularities or deficiencies in the Work.

4. A representative of the Owner's testing laboratory, who has reviewed and is familiar with the Project and Specifications, shall participate in all preconstruction conferences. The testing firm shall coordinate material testing and inspection requirements with the Contractor and its Subcontractors consistent with the planned construction schedule. The laboratory personnel shall attend, throughout the course of the Project, such conferences as may be required or requested to address quality control issues.

5. Laboratory personnel shall inspect and/or test materials, assemblies, specimens, and work performed, including design mixes, methods and techniques and furnish report(s) to the A/E and the ODR of the progress thereof.

C. Contractor's Responsibilities:

1. Cooperate with laboratory personnel, provide access to the Work, and to manufacturer's and fabricator's operations wherever the Work is in preparation or progress.

2. Secure and deliver to the laboratory, without cost to Owner, adequate quantities of representative samples of materials proposed to be used and which require testing.

3. Furnish Incidental Labor and Facilities:
   a. To provide access to work to be tested.
b. To obtain and handle samples at the Project Site or at the source of the product to be tested.
c. To facilitate inspections and tests. Furnish such labor as required to assist laboratory personnel in obtaining and handling samples at the Project Site.
d. For safe storage and curing of concrete test cylinders at Project Site and other test samples as required for field curing by ASTM C31.

4. Costs of tests, samples, and mock-ups of substitute material, where the substitution is requested by the Contractor and the tests are necessary in the opinion of the A/E to establish equality with specified items, shall be borne by the Contractor.

5. Costs of tests, samples, and mock-ups performed solely for the benefit or convenience of the Contractor shall be borne by the Contractor.

6. Notify laboratory sufficiently in advance of construction operations to allow laboratory to make assignment of personnel and scheduling of tests to complete any required checks or tests.

7. Owner's testing laboratory will conduct additional tests at Contractor's expense when initial quality control testing indicates work is defective or does not conform to requirements. Materials and workmanship not meeting the required standards or performance obligations are to be removed and replaced. Replacement and subsequent testing shall be at the expense of the Contractor.

8. Furnish concrete mix designs, in accordance with ACI 301, made by an independent testing laboratory or qualified concrete supplier. When mix designs by an independent testing laboratory are required, the laboratory shall be selected by the Contractor, approved by the A/E and ODR, and paid by the Contractor.

9. Obtain required inspections or approvals of the building official when required. All inspection requests and notifications required by the building code, are the responsibility of the Contractor.

10. Provide current welder certifications for each welder to be employed.

11. Furnish fabrication/erection inspection and testing of all welds in accordance with AWS D1.1, Chapter 6.

12. Prequalification of all welding procedures to be used in executing the Work.

1.05 SUBMITTALS:

A. General: Testing laboratory shall promptly submit written report of each and every test and inspection. Each report shall include:
   1. Date issued.
   2. Project title and number.
   3. Testing laboratory name, address, and telephone number.
   4. Name and signature of laboratory personnel.
   5. Date and time of sampling or inspection.
   6. Record of temperature and weather conditions.
   8. Date of test.
   9. Location of sample or test in the Project.
   10. Type of inspection or test.
   11. Results of tests and observation regarding compliance with Contract Documents.
   12. Interpretation of test results, when requested by Architect.

B. State in report all details of each inspection and test. Indicate compliance or noncompliance with requirements of the Contract Documents. Also state in report any and all unsatisfactory conditions.
C. In addition to furnishing a written report, notify the A/E, the ODR and the Contractor verbally of any uncorrected conditions or failures to comply with the requirements of the Contract Documents.

D. At completion of each trade or branch of the Work requiring inspecting and testing, submit a final certificate attesting to satisfactory completion of the Work and full compliance with requirements of Contract Documents.

E. Upon completion of building, testing laboratory shall furnish, to ODR and A/E, statement that all required tests and inspections were made in accordance with requirements of Contract Documents.

1.06 REFERENCED STANDARDS

A. The latest edition of all standards references in this section shall apply, unless noted otherwise. In case of conflict between these Contract Documents and a referenced standard, the Contract Documents shall govern. In case of conflict between these Contract Documents and the building code, the more stringent shall govern.

PART 2 – PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION
SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES:
   A. General requirements.
   B. Temporary utilities and services
   C. Construction aids
   D. Barriers and enclosures.
   E. Security.
   F. Parking, access roads and traffic
   G. Temporary controls.

1.02 RELATED SECTIONS:
   A. Section 01 10 00 - Summary of Work.
   B. Section 01 74 00 - Cleaning.
   C. Section 01 77 00 - Closeout Procedures

1.03 GENERAL REQUIREMENTS:
   A. Contractor shall provide all construction facilities and temporary controls specified in this Section and as necessary for the proper and expeditious prosecution of the Work.

   B. The Contractor shall make or have made and pay all charges for all connections to and distribution from existing services and sources of supply. Contractor will not be billed for utilities when the utilities are obtained from an existing building where the existing utilities are available. Verify exact requirements with Campus Utilities (as specified herein) for construction of new buildings and work on other facilities that do not have the required temporary and/or permanent utility services utilities or are not currently metered.
C. Requirements of service and utility companies relating to the Work shall be ascertained by Contractor. Comply with all requirements, including those relating to continued protection and maintenance until completion of Work.

D. Materials and construction for construction facilities and temporary controls may be new or used, must be adequate in capacity for required usage, and must not create unsafe conditions. Comply with requirements of federal, state and local authorities having jurisdiction.

E. Construction facilities and temporary controls shall be maintained by Contractor in usable condition at all times until completion of Work or when their removal is authorized by A/E or ODR.

F. Relocate temporary services and facilities as required by progress of construction, by storage or work requirements, to accommodate legitimate requirements of the Owner and other contractors employed at the Site, and when directed by the ODR.

G. When any portions of permanent systems are in operating condition, that part of the system may be used for construction purposes provide that the Contractor:
   1. Obtains ODR's approval,
   2. Assumes full responsibility for the system used,
   3. Pays all costs for operation, maintenance, cleaning, and restoration of the system to as new condition,
   4. Operates the system under the supervision of the Subcontractor responsible for system installation and ultimate performance,
   5. Does not effect specified warranty.

H. Completely remove temporary services and facilities when their use is no longer required and/or at completion of Project, when directed by ODR.

I. Clean and repair damage caused by temporary services and facilities to new condition for new Work and to a condition as good as or better than existed prior to start of Work for existing construction, services, and facilities.

1.04 TEMPORARY UTILITIES AND SERVICES:

A. General
   1. Existing utility service connections and metering in renovation and construction
   2. Utility connections, investigations and Contractor charges for construction or renovation
B. College Station: Texas A&M University maintains and operates full service utility production and distribution assets which serve the College Station campus. Temporary and/or permanent utility services and metering required for a project may include primary and secondary type Electrical Distribution Systems, Chilled Water, Heating Hot Water, Domestic Cold Water, Domestic Hot Water, Sanitary Sewer, and Refuse Collection.

C. College Station: Unless otherwise noted in the contract documents, Texas A&M University, Utility Energy Services (TAMU UES) will investigate, approve, extend and activate all temporary and permanent utility services and metering to construction sites, campus facilities, buildings and structures. The extent of service connection responsibilities may differ considerably between projects and will be clearly denoted on the contract drawings. The guidelines and procedures for utility services including forms can be found at http://utilities.tamu.edu/guidelines-and-procedure-for-utility-service/

1.05 TEMPORARY UTILITY CONNECTIONS AND METERING FOR CONSTRUCTION

A. Temporary Toilets and Sanitation: Provide service, clean, and maintain sanitary conveniences with proper enclosures, in conformance with requirements of local laws and ordinances governing such installations. Post notices, take such precautions as may be necessary, and do cleaning necessary to keep the building and the premises in a sanitary condition. From start of the Work, provide suitable temporary toilets and enclosures for the use of the workmen on the Project. Maintain these facilities in a sanitary condition. Use of Owner's existing toilet facilities will not be permitted.

B. Temporary Fire Protection: Construction practices, including cutting and welding, and fire protection during construction shall be in accordance with applicable requirements of federal, state, and local authorities having jurisdiction. Provide prominently located multi-purpose portable fire extinguishers, with at least one in each wing on each floor.

1. Gasoline and other flammable liquids shall be stored in Underwriter's Laboratories listed safety containers. Storage shall not be permitted within the building.

2. Do not light fires of any kind in or about the premises. The use of salamanders is prohibited.

3. Schedule the Work so that the permanent fire protection system is installed and made operable at the earliest possible date. At such time, the Contractor shall furnish sufficient hose to provide adequate coverage of each floor.

4. All tarps that may be used for any purpose during the construction of the Work shall be made of material which is resistant to fire, water, and weather.
1.06 CONSTRUCTION AIDS:

A. Material and Personnel Hoists: The Contractor shall provide material hoists as required for normal use by all trades, without charge. The Contractor shall also provide a personnel hoist for the transportation of all workmen as required for normal use, without charge.
   1. Employ qualified, skilled operators for the material and personnel hoists.
   2. Provide all necessary guards, signals, safety devices, required for safe operation, and suitable runways from hoists to each floor level and roof.
   3. The construction and operation of the hoists shall conform to all applicable requirements for the American Standard Safety Code for Building, the "Manual of Accident Prevention in Construction" of the AGC, and shall be approved by the insurance underwriters.

B. Temporary Stairs, Ladders, Scaffolds, Runways, and Similar Facilities:
   1. Provide and maintain all temporary equipment and construction such as temporary stairs, ladders, ramps, scaffolds, hoists, runways, derricks, chutes, and similar facilities as necessary for the proper execution of the Work. Derricks, cranes, and similar facilities shall comply with local airport restrictions.
   2. Provide temporary protective treads, handrails, and wall coverings at stairways.
   3. Scaffolding shall be furnished, installed, maintained, and removed as necessary for proper execution of the Work and shall be erected on the side of the wall on which facing work occurs. Scaffolding shall not be built into any finish facing material.

1.07 BARRIERS AND ENCLOSURES:

A. General: Construct temporary barricades, warning signs, hazard and warning lights, walks, passage-ways, and similar temporary barriers and enclosures that are necessary to protect persons and property from hazards or damage due to construction operations, and required by university, city, state or federal laws, ordinances or codes.

B. Movable Fences: Fences that need to be moved frequently for access to the Site or to be movable tree protection shall be 6' high posts, using 5" non-climb wire fabric, 12.5 gauge galvanized wire, 2" wide x 4" high openings, attached to posts set in concrete within an old tire to prevent post bases from marring pavements and sidewalks.

C. Tree Damage: When trees other than those indicated or approved for removal are destroyed, killed or badly damaged as a result of construction operations, the Contract Sum will be reduced by the amount determined from the following International Shade Tree Conference formula: $D \times D \times 0.7854 \times 28.00$, where $D$ is the diameter of the trunk measure 12" above grade.
D. Fence Maintenance and Removal: All fencing and gates shall be maintained deep, straight and level, having a neat and uniform appearance during the construction period and upon completion, before acceptance of the Work, shall be removed from the Site and post hole filled to original condition.

E. Temporary Enclosures and Protection:
1. Provide temporary weather-tight enclosure at exterior walls for successive areas of the building as work progresses, as necessary to provide acceptable working conditions, provide weather protection for interior materials, allow for effective temporary heating, and to prevent entry of unauthorized persons.
2. Temporary Partition and Ceiling Enclosures: Framing and sheet materials which comply with structural and fire rating requirements of applicable codes and standards.
   a. Close joints between sheet materials, and seal edges and intersections with existing surfaces, to prevent penetration of dust or moisture.
   b. Provide temporary doors with self-closing hardware and padlocks as required for security.
   c. Provide removable portions of enclosures as necessary for work and for handling of materials.
3. Protection of Installed Work: Provide protection for installed Work so that it will be without damage at time of acceptance by ODR. Control traffic to minimize damage. Provide protective coverings at walls, projections, jambs, sills and soffits of openings. Protect finish floors and stairs from traffic, movement of heavy objects, storage and similar construction operations. Prohibit traffic and storage on waterproofed and roofed surfaces, on lawn and landscaped areas.
   a. Concrete, cement, mortar, grout, sludge, plaster and similar materials shall not be placed in or washed down storm and sanitary sewers, plumbing lines or fixtures.
4. Protect improvements on Owner's and adjoining properties.

F. Site: Unless otherwise specified or directed, carefully protect existing walks, lawns, other buildings, and other work on Site, whether specifically indicated on the Drawings or not. Damaged areas of curbs, walks and paving will not be permitted to be patched; remove entire section between expansion joints in which the damage occurs and replace with construction to match existing adjacent work.

G. The Contractor is responsible for damage to the Work and injury to persons due to failure of barriers and enclosure of work to adequately protect it; and wherever evidence is found of such damage, the Owner may order the Work so damaged to be immediately removed and replaced by the Contractor. All costs and expenses for such occurrences shall be the responsibility of the Contractor at no additional expense to Owner. The Contractor's responsibility for maintenance of barriers and enclosure work, shall not cease until the Project has been completed and is accepted by the Owner.
1.08 SECURITY:

A. The Contractor shall provide a security program and facilities to protect the Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, and theft. Coordinate with Owner's security program. Project security within “limits of construction” is Contractor's responsibility.

1.09 PARKING, ACCESS ROADS AND TRAFFIC:

A. Parking: Parking for workmen employed on the Site may be provided within construction limits or at a remote location, if needed, to the extent that space for that purpose may be available without interference with the activities related to performance of the Work. On campus parking, other than within construction limits, shall only be as approved by ODR. Contractor shall pay all associated parking fees.

B. Provide temporary roads as required to bring vehicles onto the Site. Restore new paving used for construction operations to new condition prior to acceptance of Work by Owner.
   1. Restrict vehicles from doing unnecessary damage to the Site and any existing paving.
   2. Restore all new or existing improvements damaged by this Work to original condition, as acceptable to Owner or other parties having jurisdiction.

C. Traffic Control: Prior to start of Work, examine construction vehicle routing, and establish safeguards and procedures necessary to carry out the Work. In addition, be responsible for and observe the following:
   1. Be responsible for controlling construction traffic within and adjacent to the Site.
   2. Provide all entrances, lifts and safeguards required or necessary to the progress of the Work, and effectively control such traffic to provide minimum hazard to the Work and all persons.
   3. Route all construction equipment, trucks, and similar vehicles on existing public streets to and from the Site as approved by the ODR or as indicated on the Drawings.
   4. Construct and maintain temporary walks for pedestrians. Keep streets adjacent to the Site open to vehicular and pedestrian traffic.
   5. Maintain constant access for police, fire and ambulance service.
   6. Provide and maintain for proper control of traffic and safety:
      a. All necessary barricades, suitable and sufficient lights, reflectors, and danger signals,
      b. Warning and closure signs, directional, and detour signs,
      c. All traffic control devices furnished and installed in compliance with the Texas Manual on Uniform Traffic Control Devices as prepared by the State Department of Highways and Public Transportation.
   7. The Contractor shall provide on a 24 hour basis for all restricted and dangerous conditions existing on or adjacent to the Site.
a. For nighttime safety illuminate barricades, danger signals, warning signs and obstructions,
b. Keep warning lights burning from sunset until sunrise.

1.10 TEMPORARY CONTROLS:

A. Cleaning During Construction: Contractor at all times shall keep the premises free from accumulation of waste materials and rubbish caused by operations for the Work. Provide a collection can at each area used for eating. Pick up garbage daily. Keep Project Site free of garbage, trash, vermin and rodent infestation. Contractor, by agreement, shall require each Subcontractor to collect and deposit waste and rubbish caused by Subcontractor operations at pre-designated location. Clean interior areas prior to start of finish Work. Maintain areas free of dust and other contaminates during finishing operations.

B. Noise Control: In and around occupied areas, minimize use of noise producing equipment. Work with noise-producing is subject, at all times, to ODR's approval of entire procedure. Use only on a scheduled basis as agreed with ODR prior to start of Construction operations.

C. Water Control: Provide methods to control surface water to prevent damage to Project, site of adjoining properties. Control fill, grade and ditch to direct surface drainage away from excavations, pits, tunnels and other construction areas. Direct drainage to proper runoff.
   1. Provide, operate and maintain hydraulic equipment of adequate capacity to control surface and water.
   2. Dispose of drainage water in a manner to prevent flooding, erosion or other damage to any portion of site or to adjoining areas.
   3. Refer to the appropriate section in Division 2 of these Specifications for TPDES requirements.

D. Pollution Control:
   1. Provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by discharge of noxious or hazardous substances from construction operations.
   2. Provide equipment, personnel and perform emergency measures required to contain any spillages, and to remove contaminated soil or liquids. Excavate and dispose of contaminated earth off site and replace with suitable compacted fill and topsoil.
   3. Take special measures to prevent harmful substances from entering public waters. Prevent disposal of wastes, effluents, chemicals or other such substances adjacent to streams or in sanitary or storm sewers.
E. Dust Control: Provide positive methods and apply dust control materials to minimize raising dust from construction operations and provide positive means to prevent air-borne dust from dispersing into atmosphere.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION
SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. General Requirements.
B. Manufacturer’s Instructions
C. Transportation and Handling.
D. Storage and Protection.

1.02 RELATED SECTIONS:

A. Section 01 10 00 - Summary of Work.
B. Section 01 25 00 - Substitution Procedures.
C. Section 01 31 00 - Project Management and Coordination.
D. Section 01 33 00 - Submittal Procedures: List of Materials.
E. Section 01 34 00 - Shop Drawings, Product Data and Samples.
F. Section 01 50 00 - Temporary Facilities and Controls: Material Storage Facilities.
G. Section 01 77 00 - Closeout Procedures.

1.03 GENERAL REQUIREMENTS:

A. In addition to Uniform General and Supplementary Conditions (UGSC) requirements, Contractor shall use materials and equipment that are:
1. New, unless otherwise specified, and that are of good quality, free from faults and defects, and in conformance with the requirements of the Contract Documents.
2. Suitable for use and function intended.
3. Corresponding in quality to related materials in the absence of a complete specification.
4. Of quality appearance where exposed to view.
5. Of one manufacturer or source for the same specific purpose, with uniform appearance and physical properties.
6. Interchangeable and be the same, when required to be supplied in quantity.
7. Free of name, trade mark, or other insignia which is intended to identify the manufacturer, vendor, or other source(s) which is surface applied or affixed to any manufactured articles, materials, and items of equipment in any public area or similar locations within the Project. Any manufactured articles, materials, and items of equipment which bears evidence that an insignia, name, or trade mark has been removed shall not be used. Code required labels, such as Underwriters Laboratory labels, and other identification required by the Contract Documents are accepted.

B. Product Color, Texture, or Pattern Selection: No work requiring the A/E's review for color, texture and pattern selection shall be fabricated, delivered or installed prior to review and selection by the A/E.

1. Contractor shall select products of a named manufacturer that complies with the specified requirements and submit the full range of available colors, textures, patterns, including custom colors, textures and patterns for the A/E's selection. All subsequently approved products of other manufacturers are approved contingent upon availability of equivalent colors, textures, and patterns available to the A/E for selection.

2. When "match existing color" is indicated or specified, Contractor shall, in addition to material and construction requirements specified elsewhere, match existing color, texture, and pattern in every respect, as approved by the A/E.

3. When materials have a natural range of color, texture, and pattern such as natural stone, brick, tile, anodized aluminum finish and other exposed materials and finishes, the Contractor shall submit required number of sets of ranges of color, texture, and pattern, including representative naturally occurring defects as appropriate, for the A/E's review. All work fabricated and installed shall be within range of samples approved by the A/E. In addition, Contractor shall refer selection of raw materials containing defects within limits of the A/E's approved range of samples, to the A/E to provide distribution of such throughout required work so as to avoid patterns and concentrations of such defects.

C. Source Limitations: To the fullest extent possible, provide products of the same generic kind, from a single source, for each item of the Work.

1. When specified products are available from only sources that do not or cannot produce an adequate quantity to complete Project requirements in a timely manner, consult with the A/E for a determination of what product qualities are most important before proceeding. The A/E will designate those qualities, such as visual, structural, durability, or compatibility, that are most important. When Architect's determination has been made, select products from those sources that produce products that possess the most important qualities, to fullest extent possible.
D. Compatibility of Options: Where product options are permitted, select products that are compatible with other products to be incorporated into the Work, including products previously selected.

1.04 MANUFACTURER'S INSTRUCTIONS:

A. Install products in accordance with manufacturer's printed instructions. Obtain and distribute copies of such instructions to installer, including one copy to the A/E and one to the ODR. Maintain one set of complete instructions at the Site during installation and until completion.

B. Manufactured articles, materials, and items of equipment shall be handled, stored, applied, installed, connected, erected, used, cleaned, adjusted, conditioned, and protected in accordance with manufacturer's printed instructions and specifications for the Project conditions indicated, within manufacturer's published limitations, and requirements specified.

C. Should any manufactured articles, materials, and items of equipment be found to be damaged, deteriorated, or otherwise contrary to the requirements of the Contract Documents, remove and replace such damaged or deteriorated articles, materials, and items of equipment, no matter in what stage of completion and replace with new materials.

D. Should Project conditions or specified requirements be in conflict with manufacturer's instructions, request written clarification from the A/E before proceeding. Do not proceed with work without clear instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

E. Keep a copy of material safety data sheets for all products used in the Work, at Contractor's field office.

1.05 TRANSPORTATION AND HANDLING (see UGSC):

A. Arrange deliveries of materials and products in accordance with Construction Progress Schedule.

B. Transport products by methods to avoid product damage; deliver in undamaged condition in manufacturer's unopened containers or packaging, dry.

C. Provide equipment and personnel to handle products by methods to prevent soiling or damage.

D. Promptly inspect shipments to ensure that products comply with requirements of the Contract Documents and approved submittals, that quantities are correct, and products are undamaged.
1.06 STORAGE AND PROTECTION:

A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products, including factory-finished items and similar work, in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions. Comply with applicable laws, ordinances and regulations for protective storage of potentially dangerous materials.

B. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.

C. Store loose granular materials on solid surfaces in a well-drained area and prevent mixing with foreign matter.

D. Arrange storage to provide access for inspection at all times. Periodically inspect to assure products are free from damage or deterioration, and are maintained under required conditions.

E. At end of each day's work, cover new work likely to be damaged. Provide substantial coverings necessary to protect installed products from damage, traffic, and subsequent construction operations. Refer to Section 01 50 00 for additional requirements, including removal of temporary protections.

F. Contractor shall provide inspection of Subcontractor's material for compliance with submittals on proper storage.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION
SECTION 01 72 50
 FIELD ENGINEERING

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Performance requirements.

1.02 RELATED SECTIONS:

A. Section 01 10 00 - Summary of Work.
B. Section 01 77 00 – Closeout Procedures.

1.03 PERFORMANCE REQUIREMENTS:

A. General: Provide and pay for field engineering services including survey, layout, civil, structural or other licensed professional engineering services specified, or required to execute the Work.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 PREPARATION:

A. Verify locations of survey control points with the ODR prior to starting Work.

B. Verify all dimensions and compare to existing conditions prior to laying out the Work. Promptly notify the A/E of discrepancies discovered. Extra compensation will not be allowed because of differences between actual measurements and indicated dimensions.

3.02 LAYOUT REQUIREMENTS:

A. Establish adequate and clearly defined reference lines and levels required for execution of Work; locate and lay out, by instrumentation and similar appropriate means, controlling lines and levels required for the various trades.

B. From time to time verify layouts by the same methods.

END OF SECTION
SECTION 01 73 50
CUTTING AND PATCHING

PART 1 - GENERAL

1.01 SECTION INCLUDES:
   A. Submittals required.
   B. Materials required.
   C. Procedures for cutting and patching.

1.02 RELATED SECTIONS:
   A. Section 01 10 00 - Summary of Work.
   B. Section 01 25 00 - Substitutions Procedures.
   C. Section 01 31 00 - Project Management and Coordination.
   D. Section 01 60 00 - Product Requirements.
   E. Other Technical Sections:
      1. Cutting and patching required being performed incidental to Work of the Section.
      2. Advance notification to trades responsible for Work of other Sections
      3. Coordination of trades responsible for Work of other Sections.

1.03 SUBMITTALS:
   A. Submit written request sufficiently in advance to allow ODR and A/E time to adequately review and make a determination of approval of cutting, drilling, or alteration which affects:
      1. Work of Owner or any separate Contractor.
      2. Structural value or integrity of any element of Project.
      3. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
      4. Efficiency, operational life, maintenance, or safety of Project equipment elements.
      5. Visual qualities of sight-exposed elements.
      6. Damage to existing Work or utilities.
   B. Include in request:
      1. Identification of Project.
      2. Location and description of affected Work.
      3. Necessity for cutting, drilling, alteration, or excavation.
      4. Effect on Work of Owner or any separate Contractor, or on structural or weatherproof integrity of Project.
      5. Description of proposed Work:
         a. Scope of cutting, patching, alteration or excavation.
         b. Trades who will perform the Work.
         c. Products proposed to be used.
d. Extent of refinishing to be done.

6. Alternative to cutting, drilling, patching, and excavation.
7. Written permission of separate contractors who’s work is affected.
8. Date and time Work will be performed.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Provide materials and procedures required for original installation.

B. For any change in materials, submit request for substitution under provision of Section 01 25 00 - Substitution Procedures.

PART 3 - EXECUTION

3.01 GENERAL:

A. Field Conditions: Check and verify Contract Documents and field conditions before proceeding with Work. If there are any questions regarding these or other coordination questions, the Contractor is responsible for obtaining clarification from the A/E before proceeding with Work or related Work in question.

B. Execute cutting, drilling, and patching, including excavation and fill as required to complete the Work, and to:
   1. Fit the several parts together, to integrate with other Work.
   2. Uncover Work to install ill-timed Work.
   3. Remove and replace defective and non-conforming Work.
   4. Remove samples of installed Work for testing.
   5. Provide openings in elements of Work for penetrations of mechanical and electrical work.
   6. Uncover Work to allow for A/E’s and ODR’s observation of Work which has been covered prior to observation by A/E and ODR.

3.02 INSPECTION:

A. Inspection: Carefully examine the premises to determine the extent of Work and the condition under which it must be done, including elements subject to movement or damage during cutting, patching, excavating and backfilling. No extra payments will be allowed for claims for additional work that could have been determined or anticipated by such inspection. After uncovering Work, inspect conditions affecting installation of new products.

B. Beginning of cutting, drilling, or patching means acceptance of existing conditions.

3.03 PREPARATION:

A. Preparation Prior to Cutting: Provide adequate temporary support as necessary to assure structural value or integrity of affected portion of Work. Provide protection from elements for that portion of the Project which may be exposed by cutting and patching work, and maintain excavations free from water.
B. Protection: Provide barricades, coverings, fences, supports, and similar temporary protections necessary to protect persons and property from injury or damage as a result of Work of this Section. Confine operations to required limits and take reasonable precautions to protect remainder of property from damage.

C. Dust Control: Control dust resulting from cutting and patching to prevent the spread of dust to adjacent occupied areas and to avoid creation of a nuisance in the adjacent surrounding area. Use of water will be permitted as indicated. Provide drop cloths or other suitable barriers to prevent dust from traveling to adjacent areas. Seal off return air registers or other mechanical systems to prevent dust from entering such systems.

3.04 PERFORMANCE:

A. Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

B. Employ original installer to perform cutting and patching for weather-exposed, moisture-resistant elements, sight-exposed surfaces, and to preserve Owner's warranties and bonds for Work of this Contract and related work of other contracts.

C. Cut rigid materials using masonry saw or core drill. Pneumatic tools are not allowed without prior written approval by the ODR.

D. Restore Work which has been cut or removed using new products in accordance with requirements of Contract Documents.

E. Fit and seal interior Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces. Fit and seal for water-tightness all penetrations through exterior envelope and through slabs.

F. At penetrations of fire-rated wall, ceiling, or floor construction, completely seal all voids with fire stopping and sealant material, full thickness of the construction element to provide a smoke seal and penetration rating equivalent to adjacent rated construction. Refer to appropriate sections of Division 7 in these Specifications for requirements.

G. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit as follows:
   1. Walls: From floor to ceiling and between the nearest corner. New gypsum board construction meeting existing construction in same plane shall be flush with no visible joint showing,
   2. Ceiling: The complete surface,
   3. Floor: The complete surface unless otherwise shown or unless a matching patch in applied finishes can be made acceptable to A/E and ODR,
   4. Openings: The entire unit including frame,
   5. Painted Cabinets: The entire painted surface,
   6. Transparent Finish Cabinets: Finish new surfaces to match existing,
   7. Base: Between the nearest corners.

H. Excavation: Refer to appropriate sections of these Specifications.
I. **Damage:** Restore accidental or careless damage to Work to a condition as good as or better than existed before Work was commenced and at no additional cost to the Owner.

END OF SECTION
PART 1 - GENERAL

1.01 SECTION INCLUDES:
   A. General requirements for cleaning.
   B. Materials for cleaning.
   C. Procedures for cleaning.

1.02 RELATED SECTIONS:
   A. Section 01 10 00 - Summary of Work.
   B. Section 01 33 00 - Submittal Procedures.
   C. Section 01 50 00 - Temporary Facilities and Controls.
   D. Section 01 77 00 - Closeout Procedures.

1.03 GENERAL REQUIREMENTS:
   A. General: In addition to Uniform General and Supplementary Conditions, Article 3 (see UGSC), provide progress and final cleaning as specified in this section.
   B. Progress Cleaning: Keep premises and public properties free from accumulations of waste, debris and rubbish, caused by operations. Maintain Project in accord with State and local safety, health, and insurance standards.
   C. Final Cleaning: At completion of Work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all exposed surfaces of building and Project Site, including crawl spaces; leave Project clean and ready for occupancy.
   D. Final Inspection: Prior to final inspection, clean all surfaces and remove all debris from project.

PART 2 - PRODUCTS

2.01 CLEANING MATERIALS:
   A. Use materials which will not create hazards to health or property, and which will not damage surfaces.
   B. Use only materials and methods recommended by manufacturer of material being cleaned.
PART 3 - EXECUTION

3.01 CLEANING:

A. In addition to removal of debris and cleaning specified in other sections, clean interior and exterior exposed-to-view surfaces affected by Work of this Contract.

B. Hazards Control: Store volatile waste in covered metal containers and remove from premises daily. Prevent accumulation of wastes which create hazardous conditions. Provide adequate ventilation during use of volatile or noxious substances.

C. Clean permanent filters of ventilating equipment and replace disposable filters when units have been operated during construction; in addition, clean ducts, blowers, and coils when units have been operated without filters during construction.

D. Remove waste, debris, and surplus materials from site. Clean paving areas, walks, drives and streets in the vicinity of the building; remove mud, rubbish, waste, stains, spills, and foreign substances from paved areas and sweep clean. Immediately clean any mud tracked out of the construction area to adjacent drives and streets by vehicles and equipment.

E. Keep the entire construction area clean and at least weekly conduct a general clean-up operation.

F. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm, sanitary drains or into the soil.

G. Do not dispose of rubbish and wastes into streams or waterways.

H. Do not dispose of excess concrete on the Project Site or campus.

I. Provide on Site containers for collection of waste, debris and rubbish. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights. Do not fence, block, cover, otherwise make inaccessible, for Owner's use, any waste containers located inside or outside construction limits.

J. Remove temporary protection and labels not required to remain.

K. Just prior to painting and similar finishing operations, clean interior areas ready to receive finish, and continue cleaning as needed, until building is ready for Substantial Completion.

L. Disposal: Remove waste materials, debris and rubbish from the Project Site and provide for legal disposal at a Texas Department of Health (TDH) permitted solid waste facility. In hauling material from the Project Site, Contractor shall prevent debris from dropping from vehicles and littering the campus or area streets and roads. Contractor shall promptly remove any debris which falls from vehicles.
3.02 FINAL CLEANING

A. Employ experienced workmen or professional cleaners and perform cleaning in accordance with manufacturer's written recommendations, using products approved by the manufacturer for material being cleaned.

B. Prior to final inspection and the Owner's acceptance of the Work, perform final cleaning of all areas of the building and Project Site, performing all operations specified in the various Sections of Project Specifications. Final cleaning operations include, but are not limited to:
   1. Remove waste, debris, and surplus materials of any nature from Site. Clean paving areas in the vicinity of the building; remove stains, spills, and foreign substances from paved areas and sweep paved areas clean and rake clean other surfaces of grounds,
   2. Broom cleaning of all exposed concrete floors,
   3. Cleaning all exposed painted and unpainted metals,
   4. Cleaning all architectural woodwork,
   5. Cleaning all doors and polish hardware; removing excess paint and stains,
   6. Cleaning all glass areas, exterior and interior,
   7. Cleaning all storefront framing and doors, and glazed wall system members, exterior and interior,
   8. Cleaning all walls and floors,
   9. Vacuum all carpeted floors,
   10. Cleaning all exposed surfaces of light fixtures, including removal of construction dust, paint overspray, finger prints, and similar soiling from light fixture bodies, reflectors, and both sides of light fixture lenses,
   11. Removing and disposing of all temporary protections,
   12. Repair, patch and touch-up marred surfaces to match adjacent surfaces,
   13. Prior to Final Completion, inspect exposed interior and exterior surfaces and work areas to verify that entire work is clean.

C. Clean finishes free of dust, stains, films, and other foreign substances.

D. Clean transparent and glossy materials to a polished condition; remove foreign substances. Polish reflective surfaces to a clear shine.

END OF SECTION
SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Instruction of using personnel.

B. Submittals.

1.02 RELATED SECTIONS:

A. Section 01 10 00 - Summary of Work.

B. Section 01 29 00 – Payment Procedures.

C. Section 01 32 00 – Construction Progress Documentation.

D. Section 01 33 00 – Submittal Procedures.

E. Section 01 50 00 – Temporary Facilities and Controls.

F. Section 01 74 00 – Cleaning and Waste Management.

1.03 INSTRUCTION OF USING PERSONNEL:

A. The Contractor will provide demonstrations; conduct training and familiarization sessions for physical plant/User personnel on the mechanical and electrical systems in the facility prior to Substantial Completion inspection. Arrangements for these instruction periods shall be made by the ODR. Operation and maintenance manuals must be available and used during this training period. Refer to Section 01 78 23 for requirements of Operating and Maintenance Manuals.

1.04 SUBMITTALS:

A. Refer to Section 01 29 00 - Payment Procedures for required administrative action and submittals which must precede or coincide with Contractor's final payment application. Contractor shall deliver these submittals to ODR, properly executed, prior to the request for final payment.

B. Final Completion (see UGSC): Submit written request for Final Completion inspection and the following:

1. Certification that Work is complete and Owner has full access and use of completed work, Contract Documents have been reviewed, and systems and equipment have been tested, are operational and User personnel have received proper instruction and training on equipment and systems.

2. Copy of list of items to be completed or corrected from Substantial Completion Inspection, with each item initialed and showing date completed.

3. Evidence of compliance with requirements of governing authorities:
a. Certificates of occupancy.
b. Certificates of final inspection for elevator, plumbing, mechanical, fire protection, electrical, and other systems required by governing authorities.

4. List of all Subcontractors and material suppliers and product description. Provide name, address, and complete phone number:
a. Product manufacturer.
b. Installer (Subcontractor).
c. Local representative.
d. Local source of supply for parts and replacement.

5. Submit test/adjust/balance records; start-up performance reports, and other information relevant to Owner's occupancy.

6. Clean-up: Project site and areas used by Contractor shall be cleaned in accordance with all requirements listed in the Project Manual and Drawings.

7. Deliver all special tools and keys in relation to project equipment and devices to ODR.

8. Instruction Logs for Instruction of Owner's Operating Personnel: Provide copies of sign in sheets and attendance records of all sessions held for instructing Owner’s or ODR’s personnel in the operation and maintenance of installed systems and equipment.

9. Warranties: Provide a letter of warranty on Contractor’s letterhead in compliance with the Uniform General and Supplementary Conditions. Provide copies of all warranties supplied to Contractor for systems or equipment installed as part of the Work.

10. Keys, Keying Schedule, and Change over of Locks: For loaned keys and access cards for existing locks and security devices, return all loaned keys and access cards. For new locks and new security devices, refer to appropriate section in Division 8 of these Specifications for requirements.

11. Spare Parts and Maintenance Material: Refer to appropriate Sections in this Specification for requirements.

12. List of Contractor's incomplete work, recognized as exceptions to Owner's Certificate of Final Acceptance.

13. Affidavit from Contractor attesting that all materials and equipment installed by Contractor are free of hazardous substances with supporting certificates from subcontractors and suppliers.

14. Release of Liens: Submit the Release of Liens on the form provided by ODR.

15. Record Drawings: Submit drawings documenting the Work as installed, including makes and model numbers for all scheduled equipment.

16. Operations and Maintenance Manuals: Refer to Section 01 78 23, Operation and Maintenance Data for requirements.

17. Consent of Surety: Submit consent of surety to final payment.


19. Final Application for Payment.

PART 2 – PRODUCTS
NOT USED

PART 3 – EXECUTION
NOT USED

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Description:

1. This section specifies the standards that the Contractor shall follow for their scope of work related to Facilities Management Data (FM Data) Requirements.
2. This section does not negate any other section that requires Commissioning or Operations and Maintenance Data.

1.02 RELATED SECTIONS:

A. Section 01 77 00 - Closeout Procedures
B. Section 01 78 23 – Operations and Maintenance

1.03 FACILITY EQUIPMENT DATA

A. Facility Equipment Information Required

1. The Contractor shall provide facilities information in a digital format acceptable to the Owner for all assets identified in Table 01 Asset Groups that are included in the project. The minimum required information per asset are Floor, Location Asset Group, Description, Manufacturer, Model Number, Serial Number and Tag. Contractor shall also provide Owner a photo of the SSC asset sticker, photo of the asset’s name plate data, and a photo of each asset in its final location in digital format, at least 8 megapixels and in jpg format. (See photo examples)
2. Floor shall designate the level (Basement, 01, 02, 03 Roof) or the exterior by Outside.
3. Location shall be the final room numbers assigned to each space or by use of Roof or Outside.
4. Asset Group shall be one of the asset groups as identified in Table 01.
5. Description shall be a simple description of the asset. (ex. Air Handler Unit)
6. Manufacturer shall be the actual manufacturer’s name of the asset from the approved submittal and as installed.
7. Model Number shall be the complete model number of the asset from the approved submittal and as installed
8. Serial Number shall be the serial number for the asset as installed.
9. Tag shall be the tag designation for the asset as installed. (ex. AHU-1)
10. See Table 02 for acceptable format (.xlsx) of data collection.
11. All photographs shall be named in the following format xxxx-yyyyy-zz.jpg where “xxxx” represents the building number, “yyyy” represents SSC barcode number and “zz” represents the picture number sequence. (ex. 1416-28044-01)
B. Barcodes
   1. Barcodes shall be provided by the Owner for Contractor to place on equipment in field. The Contractor shall request these barcodes from the Owner, providing the total number of equipment assets to the Owner.

C. Final Deliverables
   1. The Contractor shall provide, on a USB drive, the asset information to the owner within two (2) weeks of the substantial completion date.

1.04 MEETING

   A. Contractor shall set up a meeting with the ODR and SSC to review asset groups on the project, quantity of assets on the projects, floor and location nomenclature for the project, placement of barcodes on assets and any other information necessary to complete the task prior to collecting the required information.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION
Table 01 Asset Groups

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<thead>
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<th>Asset Group</th>
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</thead>
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<tr>
<td>ACID NEUTRALIZING SYS</td>
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<tr>
<td>AHU</td>
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<tr>
<td>AIR BLOWER</td>
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<tr>
<td>AIR COMPRESSOR</td>
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<tr>
<td>AIR DEHUMIDIFIER</td>
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<tr>
<td>AIR DRYER</td>
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<td>AIR HUMIDIFIER</td>
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<td>AMMONIA REFRIG SYS</td>
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<td>AUTOCLAVE</td>
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<td>AUTODOOR</td>
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<td>BACKFLOW PREVENTER</td>
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<tr>
<td>BOILER</td>
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<td>BUILDING FIRE SYSTEM</td>
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<tr>
<td>CENTRAL VACUUM EQUIPMENT</td>
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<tr>
<td>CHAIR LIFT</td>
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<td>CHILLER</td>
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<tr>
<td>CLOTHES DRYER</td>
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<tr>
<td>COLD STORAGE ROOM</td>
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<tr>
<td>COMMERCIAL DISHWASHER</td>
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<tr>
<td>COMMERCIAL DISPOSAL</td>
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<td>COMPACTOR-TRASH</td>
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<tr>
<td>CONDENSING UNIT</td>
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<td>CONVEYING SYSTEM</td>
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<td>COOKER/OVEN/STOVE</td>
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<td>DEHUMIDIFIER</td>
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<td>DESCALER</td>
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<td>DOCK LIFT</td>
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<td>DOOR-OVERHEAD</td>
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<td>DRINKING FOUNTAIN</td>
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<td>DUST COLLECTOR</td>
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<td>ELECTRIC GATE</td>
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<td>ELECTRICAL DISTRIBUTION</td>
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<td>ENTHALPY WHEELS</td>
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<td>ENVIRONMENTAL CHAMBER</td>
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<td>EXHAUST FAN</td>
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FAN-RETURN
FAN-STAIR
FIRE BACKFLOW PREVENTER
FIRE PANEL
FIRE PUMP
FOUNTAIN - OUTDOOR
GAS STORAGE TANK
GAS SYSTEM
GLYCOL FEED SYSTEM
HAND/HAIR DRYER
HEAT EXCHANGER
HOOD-VENT
ICE MACHINE
INCINERATOR
KITCHEN EQUIPMENT
LAB EQUIP WASHING SYSTEM
LAB FUME HOOD
LAB VACUUM/LAB AIR
LIFT-CRANE_HOIST
LIGHTNING PREDICTION
LOUVER
MEDICAL GAS SUPPLY SYS
MIXING VALVE
NAT-GAS-SYSTEM
NITROGEN GENERATOR
OVERHEAD DOOR
PACKAGED AIR CONDITIONER
PANELBOARDS
PLAYGROUND STRUCTURES
PUMP
PUMP-CIRC
PUMP-SUMP
RADIATOR
RESIDENTIAL DISHWASHER
RO WATER SYSTEM
ROOF SYSTEM
SOLAR PANEL
STOVE
STRAINER
SUPPLY AIR FAN
SURGEON SCRUB SINK
TANKLESS WATER HEATER
TNK-ACID
TNK-FUEL
TNK-GREASE
TRAP-PRIMER
UNIT HEATER
UPS
VACUUM EQUIPMENT
VAV-FP
VAV-NP
VFD
WALL SYSTEM
WASHING MACHINE
WATER FILTRATION SYSTEM
WATER HEATER
WATER TREATMENT
WATER-DI
WATER-RO
WATER-SPECIAL
WINDOW A/C UNIT

Table 02 Data Collection

<table>
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<tr>
<th>Asset #</th>
<th>Floor</th>
<th>Location</th>
<th>Asset Group</th>
<th>Description</th>
<th>Manufacturer</th>
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<td>01</td>
<td>118</td>
<td>PANELBOARDS</td>
<td>Main Distribution Panel</td>
<td>Siemens X5</td>
<td>SCV-001</td>
<td>1318991-030-001</td>
<td>VAV-3-5</td>
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<td>175167</td>
<td>01</td>
<td>119 A</td>
<td>FIRE PANELS</td>
<td>Fire Alarm Main Panel</td>
<td>X5</td>
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<td>VAV-FP</td>
<td>137, 138 Music Rooms</td>
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Sample Photos

END OF SECTION
SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation manuals for systems, subsystems, and equipment.
   2. Maintenance manuals for the care and maintenance of systems and equipment.

B. See Divisions 02 through 49 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.02 SUBMITTALS

A. Manual: Submit one copy of each manual in final form at least 30 days before final inspection. Architect will return comments within 15 days after receipt.
   1. Correct or modify each manual to comply with Architect's comments. Submit each corrected manual within 15 days of receipt of Architect's comments.

PART 2 – PRODUCTS

2.01 MANUALS, GENERAL

A. Format: Provide the manuals electronically in Adobe™ Portable Document Format (pdf). Bookmark the first page of each division and section. Also bookmark the first page of each item listed in the table of contents.

B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain a title page, table of contents, and manual contents.

C. Title Page: Enclose title page. Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Owner.
   4. Date of submittal.
   5. Name, address, and telephone number of Contractor.
   6. Name and address of Architect.
   7. Cross-reference to related systems in other operation and maintenance manuals.

D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single document.

1. Media: Flash Drive/Load into eBuilder.
   a. Identify flash drive with "OPERATION AND MAINTENANCE MANUAL," Building name, Building number, Project title or name, Project number, and subject matter of contents. Indicate volume number for multiple-volume sets.

2.02 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and equipment descriptions, operating standards, operating procedures, operating logs, wiring and control diagrams, and license requirements.

B. Descriptions: Include the following:
   1. Product name and model number.
   2. Manufacturer's name.
   3. Equipment identification with serial number of each component.
   4. Equipment function.
   5. Operating characteristics.
   6. Limiting conditions.
   7. Performance curves.
   8. Engineering data and tests.
   9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include start-up, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.03 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and inspection procedures, types of cleaning agents, methods of cleaning, schedule for cleaning and maintenance, and repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.04 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including maintenance instructions, drawings and diagrams for maintenance, nomenclature of parts and components, and recommended spare parts for each component part or piece of equipment:

D. Maintenance Procedures: Include test and inspection instructions, troubleshooting guide, disassembly instructions, adjusting instructions, and demonstration and training video recording if available, that detail essential maintenance procedures.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
PART 3 - EXECUTION

3.01 MANUAL PREPARATION

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

1. Do not use original Project Record Documents as part of operation and maintenance manuals.

F. Comply with Division 01 Section "Project Closeout" for schedule for submitting operation and maintenance documentation.

END OF SECTION
SECTION 02 26 23 – ASBESTOS ASSESSMENT

1.01 REPORT INFORMATION

A. The Report
1. Dated: January 28, 2019
2. Prepared By: Crystal Giles – Asbestos Management Planner
3. Title: Limited Building Inspection Report for Asbestos-Containing Building Materials
   Texas A&M University
   1554 Reed Arena, 2nd Floor
   College Station, Texas 77843

B. The Report
1. Dated: January 4, 2016
2. Prepared By: Joel Andrews - Asbestos Management Planner
3. Title: Limited Building Inspection Report for Asbestos-Containing Building Materials
   Texas A&M University
   1554 Reed Arena
   College Station, Texas 77843

C. The Report
1. Dated: November 6, 2007
2. Prepared By: Austin Environmental, Inc.
3. Title: Limited Building Inspection Report for Asbestos-Containing Building Materials
   Texas A&M University
   Reed Arena #1552
   College Station, Texas 77843

D. The Report
1. Dated: December 8, 2008
2. Prepared By: Texas A&M University- Environmental Health & Safety Department
3. Title: Limited Building Inspection Report for Asbestos-Containing Building Materials
   Texas A&M University
   Reed Arena #1554, 3rd Floor
   College Station, Texas 77843

1.02 AVAILABILITY

A. Report is included following this page.
1.03 APPLICABILITY

A. The following information on asbestos assessment is furnished by the Owner. It is included herein for use by the Contractor for bidding purposes and his general information only. The Architect will not be responsible for the accuracy of the data given herein.

B. Bidders shall visit the site and acquaint themselves with all existing conditions and make any additional investigations they deem necessary to properly bid the work and to satisfy themselves as to existing conditions. All such investigations shall be performed only under time schedules and arrangements approved in advance by the Architect.

C. No additional amounts will be made available to the successful bidder for work arising from failure to examine the site conditions.

1.04 SCOPE OF WORK

A. No asbestos contain materials were found in the existing building materials tested in the attached reports.
Limited Building Inspection Report for Asbestos-Containing Building Materials

Location: Texas A&M University
1554 Reed Arena, 2nd Floor
College Station, Texas 77843

Reference: WO#201803212

Prepared by: Crystal Giles
Asbestos Management Planner License #205731

Environmental Health & Safety
Asbestos Management Planner Agency License #200171
1111 Research Parkway, Suite 220
4472 TAMU
College Station, TX 77843-4472
Tel: 979.845.2132  Fax 979.845.1348
To: David Ritter
   Project Manager
   Facilities Services
   1371 TAMU

Date: January 28, 2019

Subject: Asbestos Inspection and Testing – 1554 Reed Arena, 2nd Floor

Please accept the asbestos inspection results for the walls, ceilings, fireproofing, duct, pipe insulation, flooring, and mastics on the second floor at Reed arena, Bldg. 1554. The limited asbestos inspection was performed by Donna Adams of TAMU – Environmental Health & Safety on January 24, 2019.

Suspect ACBM was physically handled to determine friability and bulk samples were obtained for analysis. Based on previous reports and analysis, the walls, pipe insulation, and fireproofing were determined to be homogenous with the materials inspected and sampled on December 23, 2015 and December 4, 2008 (report attached). An additional twenty-one (21) suspect materials and analyzing them under Polarized Light Microscopy with Dispersion Staining (PLM/DS), Method 40 CFR, Ch. 1, Part 763, Subpart F, Appendix A. The PLM report and chain of custody are attached to this report.

The asbestos inspection was conducted on a homogenous-area basis with the building materials sampled and tested that are suspect to contain asbestos and may be disturbed prior to or during renovation or demolition activities. Suspect asbestos-containing building materials (ACBM) that were sampled included floors, ceilings, cove base, and mastics.

RESULTS

Based on sampling and analysis, the materials were confirmed to be non-asbestos containing building material.

NOTES

Non-asbestos containing building material refers to material which does NOT contain more than one (>1%) percent asbestos by weight. Friable asbestos-containing material refers to material which contains more than one (>1%) percent asbestos by weight and when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. Non-friable asbestos-containing material is any material containing more than one (>1%) percent asbestos by weight and when dry, cannot be crumbled, pulverized or reduced to powder by hand pressure.

All materials detected/uncovered during present or future renovations or demolitions that are not listed as being sampled on the Chain of Custody Form and will be disturbed must
be sampled and analyzed prior to disturbance. All additional samples and assessments are to be conducted by properly licensed individuals.

New building materials must not contain asbestos. Manufacturers' labels or material safety data sheets (MSDS) should be reviewed and documented to ensure that any asbestos containing building products are not used during future construction.

LIMITATIONS

This report only applies to the scope of work described herein. This report describes existing conditions at the time of services. Conditions of asbestos-containing materials may change as a result of damage, deterioration, or other disturbance and may increase the potential for elevated fiber levels.

This report applies only to accessible areas observed during our field services. Asbestos-containing materials may exist in concealed inaccessible enclosures, such as areas enclosed by permanent partitions, chases, shafts, equipment, etc. Material locations and quantities may vary.

Although a good-faith effort was made to locate asbestos-containing materials in the area within the scope of work, extensive destructive inspection and/or testing was not conducted due to the expense, potential exposure hazards and/or potential regulatory violations. All surfaces, paints, wire insulation, electrical panels, fire rated doors and panels, furnishings, Heating Ventilation and Air Conditioning (HVAC) Systems, fixtures and similar materials and equipment were not sampled and analyzed due to safety concerns and/or expense. Inspection and testing for mold contamination, PCB containing light ballast, and/or other hazardous and/or regulated materials were not included in this survey.

Per the Texas Department of State Health Services Texas Asbestos Health Protection Rules, this asbestos survey report may not be used as a design specification for asbestos abatement.

Sincerely,

Crystal Giles
Individual Asbestos Management Planner License #205731
Asbestos Management Planner Agency License #200171

Donna Adams
Asbestos Inspector License #602434
Limited Building Inspection Report for Asbestos-Containing Building Materials

Location: Texas A&M University
1554 Reed Arena
Room # 041, 042, 043
College Station, Texas 77843

Reference: 2014-04623

Prepared by: Joel Andrews
Asbestos Management Planner License #205718

Environmental Health & Safety
Asbestos Management Planner Agency License #206171

1111 Research Parkway, Suite 220
4472 TAMU
College Station, TX 77843-4472
Tel: 979.845.2132  Fax 979.845.1348
To: Shannon Tipton  
Project Manager  
SSC Service Solutions  
1371 TAMU

Date: January 4, 2016

Subject: Asbestos Inspection and Testing – 1554 Reed Arena, Room # 041, 042, 043

Please accept the asbestos inspection results for the room renovations in Room 041, 042, 043 at the Reed Arena, Bldg. 1554. The limited asbestos inspection was performed by Joel Andrews of TAMU – Environmental Health & Safety on December 23, 2015.

Suspect ACBM was visually inspected and physically handled to determine friability. Based on previous reports and analysis, the 1" x 1" floor tile and mastic, lay-in ceiling tile, wall joint material and drywall were determined to be homogenous with the materials inspected and sampled on November 6, 2007 (report attached). An additional thirty (30) bulk samples were obtained for analysis and analyzed under Polarized Light Microscopy with Dispersion Staining (PLM/DS), Method 40 CFR, Ch. 1, Part 763, Subpart F, Appendix A. The PLM report and chain of custody are attached to this report.

The asbestos inspection was conducted on a homogenous-area basis with the building materials sampled and tested that are suspect to contain asbestos and may be disturbed prior to or during renovation or demolition activities. Suspect asbestos-containing building materials (ACBM) that were sampled included cove bases, carpets, 1" x 1" floor tile, domestic water supply pipe insulation, mastics, wall joint material and drywall.

SCOPE

As described to the inspector per the asbestos survey request and subsequent communication, the referenced project will include renovations of rooms 041, 042, and 043.

RESULTS

Based on sampling and analysis, the materials were confirmed to be non-asbestos containing building material.
NOTE

Non-asbestos containing building material refers to material which does NOT contain more than one (>1%) percent asbestos by weight. Fibrous asbestos-containing material refers to material which contains more than one (>1%) percent asbestos by weight and when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. Non-friable asbestos-containing material is any material containing more than one (>1%) percent asbestos by weight and when dry, cannot be crumbled, pulverized or reduced to powder by hand pressure.

All materials detected/uncovers during present or future renovations or demolitions that are not listed as being sampled on the Chain of Custody Form and will be disturbed must be sampled and analyzed prior to disturbance. All additional samples and assessments are to be conducted by properly licensed individuals.

New building materials must not contain asbestos. Manufacturers’ labels or material safety data sheets (MSDS) should be reviewed and documented to ensure that any asbestos-containing building products are not used during future construction.

LIMITATIONS

This report only applies to the scope of work described herein. This report describes existing conditions at the time of services. Conditions of asbestos-containing materials may change as a result of damage, deterioration, or other disturbance and may increase the potential for elevated fiber levels.

This report applies only to accessible areas observed during our field services. Asbestos-containing materials may exist in concealed inaccessible enclosures, such as areas enclosed by permanent partitions, chases, shafts, equipment, etc. Material locations and quantities may vary.

Although a good-faith effort was made to locate asbestos-containing materials in the area within the scope of work, extensive destructive inspection and/or testing was not conducted due to the expense, potential exposure hazards and/or potential regulatory violations. All surfaces, paints, wire insulation, electrical panels, fire rated doors and panels, furnishings, Heating Ventilation and Air Conditioning (HVAC) Systems, fixtures and similar materials and equipment were not sampled and analyzed due to safety concerns and/or expense. Inspection and testing for mold contamination, PCB containing light ballast, and/or other hazardous and/or regulated materials were not included in this survey.
Limited
Building Inspection Report for
Asbestos-Containing Building Materials

Texas A&M University
Reed Arena #1552
Lower Level South Corridor
College Station, Texas

Prepared for:

Texas A&M University
Environmental Health and Safety Department
Mr. Bob Lamkin
4472 TAMU
College Station, Texas 77843-4472

PROJECT NO:
AE07-294

Prepared by:

Austin Environmental, Inc.
P.O. Box 3725
Bryan, Texas 77805-3725
979-778-2699
979-778-2730 Fax

November 6, 2007
November 6, 2007

Texas A&M University
Environmental Health & Safety
Mr. Bob Lankin
4472 TAMU
College Station, Texas 77843

RE: Limited Asbestos Inspection Report- TAMU-Reed Arena #1552, Lower Level South Corridor, College Station, Texas

Dear Mr. Lankin:

Please accept the asbestos inspection results for the above referenced project. The limited asbestos inspection was performed by Mr. Brent W. Plant on October 22, 2007.

Suspect AGBM was physically handled to determine friability and bulk samples were obtained for analysis. The inspection involved sampling of eighteen (18) suspect asbestos-containing building materials and analyzing them under Polarized Light Microscopy with Dispersion Staining (PLM/DS), Environmental Protection Agency (EPA) Method 600/R-92/110. The PLM results, chain of custody forms and sample location drawings are attached to this report.

The asbestos inspection was conducted on a homogenous-area basis with the construction materials sampled and tested that are suspect to contain asbestos and that may be disturbed prior to renovation activities. Suspect asbestos-containing building materials that were sampled included, lay in ceiling tile, corn base mastic fireproofing, 12 x 12 floor tile, wall joint material and drywall.

RESULTS:
All samples collected and analyzed were "none detected" by laboratory analysis.

All materials detected/uncovered during present or future renovations or demolitions that are not listed, as being sampled on the Chain of Custody Form and will be disturbed, must be sampled by properly licensed individuals and analyzed prior to disturbance.

BRYAN, TX. (979) 778-2400  SEABROOK, TX. (281) 474-4121  AUSTIN, TX. (512) 517-8015
November 6, 2007
Page 2

New building materials should be addressed to ensure that they do not contain asbestos. Manufacturers' labels or material safety data sheets (MSDS) should be reviewed and documented to ensure that any asbestos-containing building products are not used during future construction.

LIMITATIONS
This report only applies to the scope of work described herein. This report describes existing conditions at the time of services. This report applies only to accessible areas observed during our field services. Asbestos-containing materials may exist in concealed inaccessible locations, such as areas enclosed by permanent partitions, ceilings, shafts, equipment, etc. Material locations and quantities may vary.

Although a good-faith effort was made to locate asbestos-containing materials in the area within the scope of work, extensive destructive inspection and/or testing was not conducted due to the expense, potential exposure hazards and/or potential regulatory violations.

All surfaces, points, wire insulation, electrical panels, fire rated doors and panels, furnishings, Heating Ventilation and Air Conditioning (HVAC) systems, fixtures, and similar materials and equipment were not sampled and analyzed due to safety concerns and expense. Austin Environmental Inc., makes no warranty and assumes no liability for the inappropriate use or misuse of this document.

If you have any questions or need additional information you can reach me at 979-778-2659.

Sincerely,

AUSTIN ENVIRONMENTAL, INC.

Brent W. Plant, M.P.H., R.S.
Individual Asbestos Consultant License No. 10-5926
Asbestos Consultant Agency License No. 10-0313

Attachments

BRYAN, TX. (979) 778-2659  SEABROOK, TX. (281) 474-1333  AUSTIN, TX. (512) 397-0925
Limited Building Inspection Report for
Asbestos-Containing Building Materials

Texas A&M University
Reed Arena #1554
3rd Floor
College Station, Texas 77843

Work Request #081120002-001

Prepared by:
Texas A&M University
Environmental Health & Safety Department
MS 4472
College Station, Texas 77843
(979)845-2132
To: Frank Cox  
Physical Plant  
1371 TAMU

Date: December 8, 2008

Subject: Asbestos Inspection and Testing – Reed Arena #1554, 3rd Floor

Please accept the asbestos inspection results for Reed Arena #1554, 3rd Floor. The limited asbestos inspection was performed by Rob Lamkin of the TAMU Environmental Health & Safety Department on December 4, 2008.

Suspect ACM was physically handled to determine friability and bulk samples were obtained for analysis. The inspection involved sampling of three (3) suspect building product materials and analyzing them under Polarized Light Microscopy with Dispersion Staining (PLM/DS), Environmental Protection Agency (EPA) Method 600/R-93/116. The PLM results are attached to this report.

The asbestos inspection was conducted on a homogenous area basis with the building materials sampled and tested that are suspect to contain asbestos and that may be disturbed prior to or during renovation activities. Suspect asbestos-containing building materials that were sampled included the ceiling tile. Based on previous reports and analysis, the building materials were determined to be homogeneous with the carpet with mastic, cove base with mastic, wallboard and joint compound previously inspected and reported by Environmental Health & Safety on October 14, 2005.

RESULTS

Based on a physical inspection and previous sampling, all materials were found to not contain asbestos.

Friable asbestos-containing material refers to material, which contains more than one (>1%) percent asbestos by weight and when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. Non-friable asbestos-containing material is any material containing more than one (>1%) percent asbestos by weight and when dry, cannot be crumbled, pulverized or reduced to powder by hand pressure.
All materials detected/uncovered during present or future renovations or demolitions that are not listed as being sampled on the Chain of Custody Form and will be disturbed must be sampled and analyzed prior to disturbance. All additional samples and assessments are to be conducted by properly licensed individuals.

New building materials must not contain asbestos. Manufacturers’ labels or material safety data sheets (MSDS) should be reviewed and documented to ensure that any asbestos-containing building products are not used during future construction.

LIMITATIONS
This report only applies to the scope of work described herein. This report describes existing conditions at the time of services. Conditions of asbestos-containing materials may change as a result of damage, deterioration or other disturbance and may increase the potential for elevated fiber levels.

This report applies only to accessible areas observed during our field services. Asbestos-containing materials may exist in concealed inaccessible enclosures, such as areas enclosed by permanent partitions, chases, shafts, equipment etc. Material locations and quantities may vary.

Although a good-faith effort was made to locate asbestos-containing materials in the area within the scope of work, extensive destructive inspection and/or testing was not conducted due to the expense, potential exposure hazards and/or potential regulatory violations. All surfaces, paints, wire insulation, electrical panels, fire rated doors and panels, furnishings, Heating Ventilation and Air Conditioning (HVAC) Systems, fixtures and similar materials and equipment were not sampled and analyzed due to safety concerns and expense. Inspection and testing for mold contamination, lead-based paint, PCB containing light ballast and/or other hazardous and/or regulated materials was not included in this survey.

Per the Texas Department of State Health Services Texas Asbestos Health Protection Rules this asbestos survey report may not be used as a design specification for asbestos abatement.

Sincerely,

Robert J. Lanikin
Individual Asbestos Management Planner License #203641
Asbestos Management Planner Agency License #360171
Per the Texas Department of State Health Services Texas Asbestos Health Protection Rules, this asbestos survey report may not be used as a design specification for asbestos abatement.

Sincerely,

[Signature]

Joel Andrews
Individual Asbestos Management Planner License #205716
Asbestos Management Planner Agency License #708171
SECTION 02 40 00 - DEMOLITION

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1 - Special Requirements, govern work under this Section whether attached hereto or not.

B. Read all other Sections of the Specifications, which together with the Drawings and this Section describes the Demolition. Verify all dimensions and conditions at the site.

C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRADES

A. Coordinate and cooperate with other trades involved in this project where the work of such trades affects or is affected by the demolition work.

B. Salvage:
   1. All removed materials and items, except those specifically indicated on the drawings to be delivered to the Owner or specifically mentioned for re-use in this renovation work, will be become the property of the Contractor and shall be removed from the site. Only those materials and items which can be salvaged and re-used in remodeling construction under this Contract shall remain at the site. Materials considered for re-use must be approved by Architect prior to incorporation into the project.
   2. Stack and store all salvaged materials and items shown to be re-used in locations as directed by the General Contractor and approved by the Architect. Provide protection to preserve stored materials and items from damage of any kind.

1.03 SCOPE OF WORK

A. Work under this Section of the Specifications consists of furnishing all labor, materials, equipment, incidentals, and the performance of all operations necessary to complete the demolition work indicated or reasonably inferred from the Drawings and Specifications. Verify all dimensions and conditions at the site.

B. Demolition work includes, but is not limited to all items as hereinafter specified. Perform all demolition work as required to prepare for new construction and as necessary for proper completion of the work.
   1. Interior:
      a. Remove existing gypsum board partitions, doors and frames, any built-in cabinets as indicated.
b. Remove existing suspended ceiling systems, lights, folding partitions and supports and portions of the existing fireproofing.

c. Remove existing toilet partitions and accessories.

d. Remove existing plumbing and fixtures at toilets.

e. Refer to Mechanical and Electrical drawings and specifications for demolition work under these Divisions.

C. General:

1. Perform all cutting and demolition work required for mechanical, plumbing, and electrical trades except as hereinafter specifically listed under "Related Work."

2. Contractor shall refer to Mechanical Drawings and Electrical Drawings as well as to Architectural Drawings as certain demolition requirements are indicated only on these mechanical and electrical drawings.

1.04 RELATED WORK

A. Trades requiring holes, openings or trenches to be cut or drilled through floors, walls, ceilings, or other construction shall perform layout work for cuts.

B. Mechanical and Electrical demolition work is specified under Division 22 thru 28 respectively.

1.05 JOB CONDITIONS

A. Occupancy: All portions of the building with areas to be demolished will be vacated and discontinued in use prior to the start of the work.

B. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner in so far as practicable. However, variations within the structure may occur by Owner's removal and salvage operations prior to the start of the demolition work.

C. Remove all items, materials and debris resulting from demolition operations from the site unless they are specifically noted for re-use or delivery to the Owner. All items not re-used in renovation operations will become the property of the Contractor and shall be removed from the site. Refer to Division 1, General Provisions, for requirements concerning removal and disposal of trash and debris.

D. Items of salvageable value to the Contractor may be removed from the structure as the work progresses. Salvaged items must be transported from the Project Site as they are removed. Storage or sale of removed items on the Project Site will not be permitted.

E. Explosives: The use of explosive will not be permitted.
F. Traffic: Conduct demolition operations and the removal of debris to ensure minimum interference with roads, streets, walks and other adjacent occupied or used facilities.
   1. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

1.06 SUBMITTALS

   A. Schedule: Submit copies of proposed methods and operations of demolition to the Architect for review prior to the start of work. Include in the schedule the coordination for shut-off, capping and continuation of utility services as required.

1.07 PROTECTION OF BUILDING

   A. Refer to supplemental general provisions for general precautions and protection.

   B. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons. Provide interior and exterior shoring, bracing, or support to prevent movement or settlement or collapse of structures to be demolished and adjacent facilities to remain.

   C. Promptly repair damages caused to adjacent facilities by demolition operations at no cost to the Owner.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 GENERAL

   A. Refer Part 1 - Scope of Work for specific information on demolition and removal of scheduled items.

   B. Pollution Controls: Use temporary enclosures and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level.
      1. Comply with governing regulations pertaining to environmental protection.
      2. Clean adjacent structures and improvements of all dust, dirt and debris caused by demolition operations, as directed by the Architect or governing authorities. Return adjacent areas to condition existing prior to the start of the work.

   C. Clean up
      1. After demolition activities are complete, remove all waste, trash, and debris resulting from the demolition work.
      2. All materials to be disposed of off site at the contractor’s expense.

END OF SECTION
SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1 - General Requirements, govern work under this Section whether attached hereto or not.

B. Read all other Sections of the Specifications, which together with the Drawings and this Section describe the Metal Fabrications work.

C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRADES

A. Cooperate and coordinate with other trades involved in this project where work of such trades affects or is affected by Metal Fabrications.

B. Items furnished under this Section will be installed by other trades unless specifically stated otherwise; furnish setting drawings, templates, and other information required for clear understanding of setting requirements.

1.03 SCOPE OF WORK

A. Work under this Section of the Specifications consists of the furnishing of all labor, materials, equipment, incidentals, and the performance of all operations necessary to complete Metal Fabrications work indicated or reasonably inferred from the Drawings and Specifications.

B. Work Included:
   1. Miscellaneous steel angles, angle frames, clip angles, angle braces, etc.
   2. Certification of Compliance for fabrication.

1.04 RELATED ITEMS

A. Section 06 10 00 - Rough Hardware

B. Section 10 22 26 – Folding Partitions.

C. Section 11 52 00 – Projection Screens

D. Section 11 52 23 – Motorized Projector Lifts

E. Section 26 51 00 – Interior Lighting
1.05 QUALITY ASSURANCE

A. As a minimum and as applicable, comply with the following:
1. American Institute of Steel Construction (AISC)
2. American Iron and Steel Institute (AISI)
   b. Specification for The Design of Cold-Formed Structural Members.
3. American Society for Testing and Materials (ASTM)
   d. A-123 - Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed; and Forged Steel Shapes, Plates, Bars, and Strip.
   f. A-500 - Specification for Cold-Formed Welded and Seamless Carbon Steel Tubing in Rounds and Shapes.
   g. A-501 - Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
   h. A-525 - Specification for General Requirements, Zinc-Coated (Galvanized) Steel Sheet by the Hot-Dip Process.
4. American Welding Society (AWS)
   a. Standard Qualification Procedures - for field welding processes and welding operators.
   b. Structural Welding Code.
5. Steel Structures Painting Council (SSPC)
   a. SSPC - SP2 Specification for Hand Tool Cleaning.
   b. SSPC - SP3 Specification for Power Tool Cleaning.

B. Field measurements:
1. To the greatest possible extent, take field measurements prior to preparation of shop drawings or fabrication of items.
2. Provide for field trimming and fitting when field measurements are not possible without delaying job progress.

C. Shop assembly:
1. To the greatest possible extent, shop assemble items to minimize field splicing and field assembling.
2. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and proper installation.

D. Special Inspection for Fabricators (Refer Sections 1704 and 1705 of the International Building Code for additional requirements):
1. If the fabricator is not registered and approved to perform the work without special inspections, then the fabricator shall provide a third party (special) inspector to verify the fabrication and implementation procedures of the fabricator.
2. Welding Inspector shall be in compliance with AWS D1.1
3. At the completion of fabrication, a Certificate of Compliance shall be submitted to the building official stating the work was performed in accordance with the approved construction documents.
1.06 SUBMITTALS

A. Make submittals in accordance with Section 01 33 00.

B. Product Data - Submit manufacturer's product specification and other data for manufactured items proposed for use.

C. Samples - Submit 2 sets of representative samples of materials and finished products as may be requested by Architect.

D. Shop Drawings:
   1. Submit shop drawings for fabrication and erection of miscellaneous metal fabrications. Include plans, elevations and details of sections and connections. Show anchorage and accessory items, including finishes. Provide templates for anchor and bolt installation as required.
   2. Where material or fabrications are indicated to comply with certain requirements for design loadings include structural computations, material properties and other information needed for structural analysis and review.

E. Certification of Compliance for fabrication.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Steel plates, shapes and bars - ASTM A-36.

B. Steel tubing - ASTM A-500 or A-501.

C. Structural steel sheets - ASTM A-570 or A-611 (Class 1) or grade required for design loading.

D. Steel pipe - ASTM A-53 or type and grade as required for design loading; standard weight (schedule 40) unless otherwise required.

E. Brackets, Flanges and Anchors - Cast or formed metal of the same type material and finish as item being supported, unless otherwise required.

F. Concrete Inserts - Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A-47, or cast steel, ASTM A-27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A-153.

G. Grout - Premixed, factory-packaged, non-staining grout equal to Five Star Grout.

H. Fasteners:
   1. General - Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for type, grade and class required for condition of use.
   2. Bolts and Nuts - Regular hexagon head type, ASTM A-307, Grade A.
   3. Lag Bolts - Square head type, FS FF-B-561.
   5. Wood Screws - Flat head carbon steel, FS FF-S-111.
8. Toggle Bolts - Tumble-wing type, FS FF-B-588.

I. Shop Paint:
1. Metal Primer Paint: Paint shall be high solids, alkyd resin type.
2. Primer selected shall be compatible with finish coats of paint. Coordinate selection of metal primer with finish paint requirements specified in Division 9.
3. Galvanizing Repair Paint - High zinc dust content paint for re-galvanizing welds in galvanize steel, complying with MIL-P-21035.

2.02 FABRICATION, GENERAL

A. Workmanship:
1. Use materials of size and thickness shown or, if not shown, of required size and thickness to produce strength and durability in finished product. Work to dimensions shown or approved on shop drawings, using proven details of fabrication and support.
2. Form work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise shown. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
3. Weld corners and seams continuously, complying with AWS recommendation. Prior to galvanizing or shop painting, grind exposed welds smooth and flush to match and blend with adjoining surfaces.
4. Fabricate exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown or, if not show, Phillips flat head (countersunk) screws or bolts.
5. Provide for anchorage of types shown or required, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
6. Cut, reinforce, drill and tap miscellaneous metal work as required to receive finish hardware and similar items.
7. Shop Painting:
   a. Shop paint miscellaneous metal work, except members or portions or members to receive fire proofing, surfaces and edges to be field welded, and galvanized surfaces.
   b. Remove scale, rust and other deleterious materials before applying shop coat. Clean off heavy rust and loose mill scale in accordance with SSPC SP-2 "Hand Tool Cleaning", or SSPC SP-3 "Power Tool Cleaning", or SSPC SP-7 "Brush-Off Blast Cleaning".
   c. Remove oil, grease and similar contaminants in accordance with SSPC SP-1 "Solvent Cleaning".
   d. Immediately after surface preparation, brush or spray on an approved primer paint in accordance with manufacturer's instructions, and at a rate to provide a uniform dry film thickness of 2.0 mils for each coat. Use painting methods, which will result in full coverage of joints, corners, edges and exposed surfaces.
   e. Apply one shop paint coat to all ferrous metal items (except galvanized items), except apply 2 coats of paint to surfaces inaccessible after assembly or erection. Change color of second coat to distinguish it from first coat.
2.03 MISCELLANEOUS METALWORK ITEMS

A. Rough Hardware:
   1. Furnish bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures.
   2. Manufacture or fabricate items to sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts, which bear on wood structural connection; elsewhere, furnish steel washers.

B. Schedule of Items:
   1. Steel angle frames, clip angles, edge angles, steel shapes, miscellaneous angles and anchors:
      a. Provide steel angles and angle fabrications as indicated on the Drawings and as required to receive, anchor, and otherwise support attached items or work such as:
         (1) Frame bracing to alter existing structural framing (joists), folding partitions, etc.
         (2) Angle frame supports at film projection screen and projector lifts.
   2. Unistrut framing:
      a. All channel members shall be fabricated from structural grade steel conforming to one of the following ASTM specifications: A 570 GR 33, A 653 GR 33 B. P-1000 – 1 5/8” x 1 5/8”, 12-gauge channel.
      b. All fittings shall be fabricated from steel conforming to one of the following ASTM specifications: A 575, A 576, A 36 or A 635.
      c. Finish –
         1) electro-galvanized (EG) Electrolytically zinc coated per ASTM B 633 Type III SC 1 for interior applications. Final finish will be field painted.
         d. All-thread support rods A307 Grade A carbon steel zinc coated (interior).

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 COORDINATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.03 INSTALLATION

A. General
   1. Set work accurately into position, plumb, level, true, and free from rack.
   2. Anchor firmly into position.
3. Where field welding is required, comply with AWS recommended procedures of manual-shielded metal-arc welding for appearance and quality of weld and for methods to be used in correcting welding work.
4. Grind exposed welds smooth and touch up shop prime coats.
5. Do not cut, weld, or abrade surfaces which have been hot-dip galvanized after fabrication and which are intended for bolted or screwed field connections.

B. Immediately after erection, clean the field welds, bolted connections, and abraded areas of shop priming. Paint the exposed areas with same material used for shop priming.

END OF SECTION
SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1 - General Requirements, govern work under this Section whether attached hereto or not.

B. Read all other sections of the Specifications, which together with the Drawings and this Section, describe the Rough Carpentry work.

C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRADES

A. Cooperate and coordinate with other trades involved in this project where the work of such trades affects or is affected by Rough Carpentry work.

B. Built-in items of other trades: Cooperate with other trades for proper installation of built-in items, provide access to carpentry work at the various stages of construction as required, confer with other trades to ascertain that their work is in place, and protect such work during execution of carpentry work.

C. Build openings, supports, nailers, headers, and frames into carpentry work as shown on Drawings or as required by other trades. Confer with the electrical and mechanical trades since any such items omitted shall be set by this Contractor without charge.

1.03 SCOPE OF WORK

A. Work under this Section of the Specifications consists of furnishing all labor, materials, equipment, incidentals, and the performance of all operations necessary to complete all Rough Carpentry work indicated or reasonably inferred from the Drawings and Specifications.

B. Work Included:
   1. Wood blocking, grounds and nailers for incorporation into, or attachment to, concrete, masonry, and/or steel framing.
   2. Rough hardware.

1.04 RELATED WORK

A. Section 06 40 00 - Finish carpentry.
1.05 QUALITY ASSURANCE

A. As a minimum and as applicable, comply with the following:
   1. Lumber Standards - PS 20 and with applicable rules of the respective grading and inspecting agencies for species and products required.
   2. Plywood Product Standards - PS 1 (ANSI A 199.1) or, for products not manufactured under PS 1 provisions, with applicable APA Performance Standard for type of plywood indicated.

B. Lumber - Identify with grade stamp of an agency certified by NFPA.

C. Fasteners - ASTM A 653/A 653M - Specification for Zinc-Coated (galvanized) Steel Sheet products by the Hot-Dip Process, minimum coating designation G90 (0.90 oz/sq ft.).

D. Fire retardant treatment to conform to applicable requirements of Underwriters' Laboratories (UL) and AWPA C20 and C27 for Type A use.
   1. Submittals are required for Fire Retardant Treatment.
   2. Submit manufacturer's literature for products proposed for use.

1.06 PRODUCT HANDLING

A. Protection of Finish Work: Cover and protect sills, jambs, concrete and finish carpentry work to protect from damage during construction. Maintain protection in good condition for as long as required or until completion of building.

B. Storage of Materials: Keep wood materials dry at all times. Deliver lumber dry. Stack lumber flat with spacers between bundles. Store on platforms or blocking, under waterproof covering and provide adequate ventilation. Placing of materials on bare ground will not be permitted.

PART 2 - PRODUCTS

2.01 LUMBER

A. General
   1. Factory mark each piece of lumber with type, grade, mill and grading agency.
   2. Nominal sizes are indicated unless shown by detail dimensions. Provide actual sizes as required by PS 20 for moisture-controlled lumber.
   3. Provide fire retardant treated lumber for all concealed members.

B. Miscellaneous Lumber
   1. Provide wood for attachment or support of other work, including rough bucks, nailers, blocking, furring, grounds, stripping and similar uses. Use "Construction Grade" light framing size lumber or boards of any species or No. 2 Southern Pine boards.
2.02  ROUGH HARDWARE

A. Nails, Spikes, and Staples: Hot-dipped galvanized (ASTM A 153/A 153M) for exterior locations, high humidity locations, and treated wood; plain finish for other interior locations; size and type to suit application. Power-driver fasteners shall comply with NES NER – 272.

B. Bolts, Nuts, Washers, Lags, and Screws: Medium carbon steel; size and type to suit application; hot-dipped galvanized for exterior locations contact with concrete construction, high humidity locations, and treated wood; plain finish for other interior locations. (Verify material for use with ALL fire retardant chemical manufacturer).
   2. Lag Bolts: ASME B18.2.1.
   3. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

C. Fasteners: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry and concrete. Bolts or power activated type for anchorage to steel.

2.03  WOOD TREATMENT

A. Fire retardant treatment:
   1. Where fire-retardant treated lumber or plywood is specified or indicated, comply with the AWPA Standard C20 and C27 for Type A use for pressure impregnation with fire-retardant chemicals to achieve a flame-spread rating of not more than 25 when tested in accordance with UL Test 723, ASTM E-84, or NFPA Test 255, after being subjected to the Standard Rain Test, ASTM D-2898.
   2. Provide UL label on each piece of fire-retardant lumber.
   3. Kiln-dry treated items to a maximum moisture content of 15 percent for plywood and 19 percent for lumber.
   4. Complete fabrication of treated items prior to treatment, wherever possible. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical.

PART 3 - EXECUTION

3.01  GENERAL

A. Discard units of material with defects, which might impair quality of work, and units, which are too small to use in fabricating work with minimum joints.

B. Set work accurately to required levels and lines, with members plumb and true and accurately cut and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit.
C. Contractor shall verify all dimensions shown on the Drawings and be held responsible for checking dimensions shown on the Drawings against job conditions to ascertain possible discrepancies in figured dimensions shown on Drawings or job conditions not permitting detailed construction. Notify the Architect before executing any portion of the work.

D. Securely attach work to substrate by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.

E. Use common wire nails or screws as determined by substrate, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required.

3.02 WOOD NAILERS, BLOCKING, SLEEPERS, GROUNDS

A. Set wood blocking for support of wood work, metal work, electrical outlets, lighting fixtures, etc., where indicated or normally required to support such items. Provide blocking and nailers to allow nailing of centers, ends and edges of wall boards where applied to wood frame construction. Provide nailers and blocking to receive all wood trim and mouldings. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.

B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
   1. Bore bolt holes same diameter as bolts; drive bolts into place to a snug fit and provide with washer and nuts. Tighten nuts, bolts and screws at installation and again at enclosure or completion.

C. Provide permanent grounds of dressed, preservative or fire treated, beveled lumber not less than 1 1/2" wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

3.03 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
B. Protect rough carpentry from weather. If despite protection rough carpentry becomes wet, apply EPS-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

3.04 CLEAN-UP

A. At the completion of the rough carpentry work, remove all excess materials and rubbish accumulated from this work and leave area clean.

END OF SECTION
SECTION 06 40 00 - FINISH CARPENTRY

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1 - General Requirements, govern work under this Section whether attached hereto or not.

B. Read all other Sections of the Specifications, which together with the Drawings and this Section describe the Finish Carpentry work.

C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRADES

A. Cooperate and coordinate with other trades involved in this project where work of such trades affects, or is affected by, Finish Carpentry work.

B. Schedule and coordinate work with other trades to provide close joining and fitting with adjoining materials and to prevent conflicts and delays.

1.03 SCOPE OF WORK

A. Work under this Section of the Specifications consists of furnishing all labor, materials, equipment, incidentals, and the performance of all operations necessary to complete all Finish Carpentry work indicated or reasonably inferred from the Drawings and Specifications.

B. Work Included:
   1. Finish carpentry.
   2. Installation of metal frames: metal frames are provided under Section 08 10 20, "Metal Frames".
   3. Installation of plastic faced doors: plastic faced doors are provided under Section 08 15 00, "Plastic Faced Doors".
   4. Installation of Finish Hardware: hardware provided is under Section 08 70 00, "Finish Hardware".
   5. Installation of items provided under Division 10 - "Building Specialties".

1.04 RELATED WORK

A. Section 06 10 00 - Rough Carpentry

B. Section 08 10 20 - Metal Frames
C. Section 08 15 00 - Plastic Faced Doors
D. Section 08 70 00 - Finish Hardware
E. Section 09 91 00 - Painting
F. Division 10 - Building Specialties

1.05 QUALITY ASSURANCE

A. As a minimum and as applicable, comply with the following:
   2. Hardwood Lumber Standards (Comply with National Hardwood Lumber Association rules) - PS 58, Basic Hardwoods.
   5. Woodworking Standard - AWI "Quality Standards".

B. Factory-mark each piece of lumber and plywood with type, grade, mill and grading agency identification; except omit marking from surfaces to receive transparent finish, and submit mill certificate that material has been inspected and graded in accordance with specified requirements if it cannot be marked on a concealed surface.

C. Finish woodwork and millwork shall be "Custom" grade in accordance with AWI "Quality Standards of the Architectural Woodwork Industry". Refer to current publication for all materials, construction, and installation requirements.

D. Work of this Section shall comply with applicable requirements of the Texas Architectural Barriers Act, as identified in the Texas Government Code, Chapter 469, Elimination of Architectural Barriers and with the Americans with Disabilities Act (ADA).

1.06 SUBMITTALS

A. Make submittals in accordance with Section 01 33 00.

B. Prior to start of woodwork fabrication, submit:
   1. Shop drawings of woodwork items. Show materials, wood species, component profiles, fastenings, jointing details, trim profiles, finishes, accessories, and general layout of the work.
   2. Representative samples of wood scheduled to receive stained or transparent finish.
   4. Wood treatment data.
1.07 PRODUCT DELIVERY AND STORAGE

A. General:
   1. Prior to delivery, inspect all woodwork to insure that no sub-grade, defective, machine-marked or otherwise damaged pieces are delivered.
   2. Store millwork and woodwork in an approved, protected area until proper storage can be provided at project site.
   3. Woodwork shall not be delivered until proper storage can be provided at project site.
   4. Arrange to have finish woodwork materials (trim, etc.) primed and back-painted immediately upon delivery to project.
   5. Do not store or erect kiln-dried materials in wet or damp portions of the project. Concrete shall be thoroughly dry in spaces before items or materials which may be damaged or affected by dampness are installed therein.
   6. Carefully cover and protect finish carpentry materials and items when in transit and at the job site.

B. Acclimatization of Wood Materials:
   1. Prior to installation, all wood materials and plastic faced doors shall be stored a minimum of two weeks in protected areas within the building.
   2. Contractor shall select and Architect approves the areas so selected.
   3. Contractor shall be responsible for maintaining temperature of such areas between 50 degrees F. and 75 degrees F. and relative humidity of 50 to 60 percent.
   4. Materials shall be stored in an acceptable manner to allow free circulation of air around all items.

C. Finish Hardware - Store in a locked place, at site under supervision of Contractor's superintendent.

1.08 PROTECTION

A. Protection of adjacent surfaces, items, and finish work from damage due to finish carpentry operations is the responsibility of this Contractor. Make good any damage to work of other trades as directed by the Architect at no expense to the Owner.

B. Materials and finish items not properly stored or which are damaged or defaced during construction will be rejected.

PART 2 - PRODUCTS

2.01 LUMBER

A. Softwood lumber: PS 20, custom grade per AWI Section 100; Southern Pine or Douglas Fir, S4S, moisture content 10 to 12%.
B. Hardwood lumber: PS 58, custom grade per AWI Section 100; Birch, Maple, Alder White or Red Oak, S4S, moisture content 10 to 12%.

2.02 DOORS

A. Metal frames will be furnished to this Section by Section 08 10 20 for installation.

B. Plastic faced doors will be furnished to this Section by Section 08 15 00 for installation.

C. Finish hardware will be furnished to this Section by Section 08 70 00 for installation.

2.03 BUILDING SPECIALITIES

A. Building Specialties will be furnished to this Section by Division 10 for installation.

2.04 ACCESSORIES

A. Fasteners:
   1. As shown and as required to suit application.
   2. Provide non-corrosive, non-oxidizing type for exterior, at high humidity areas and at treated wood locations.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Inspect finish materials, trim, doors, etc., to insure that no subgrade, defective or machine marked pieces are installed.

B. Priming and back-painting: Arrange to have all millwork, miscellaneous trim and sight exposed nailers primed and backpainted immediately upon delivery to the building.

C. Nailing:
   1. Wood trim less than 4" wide: 6d casing nails not more than 12" o.c. staggered.
   2. Wood trim 4" or wider: 2-6d casing nails 12" o.c.

D. Install work with neat cuts, close joints and firm seating. Miter or cope trim joints at corners. Set nails in exposed work 1/8" for putty. Countersink screws in exposed work and plug with matching wood unless otherwise noted.
3.02 FINISH CARPENTRY

A. Workmanship:
   1. Milling: Fabricate, assemble and finish items at mill insofar as practicable. Deliver to building ready to set in place. Machine sand items at mill or factory and sandpaper smooth to touch at building. Provide woodwork free of machine or tool marks or defects that will show through finish.
   2. Joints:
      a. Make all joints to high standard to conceal shrinkage.
      b. Mortise, tendon, dowel, block and glue joints where necessary; avoid use of nails as much as possible. Conceal nails and screws when necessary to use.
      c. Standing trim: Furnish full length for each condition of use; miter corners.
   3. Erection:
      a. Set items plumb, level and in true alignment. Provide blocking and nailers for securing in place.
      b. Blind nail wherever possible, where not possible, set nails for putty stopping. Where screws occur in exposed surfaces, counter sink heads and stop holes with wood plugs matched to surrounding surface. Hammer or tool marks on exposed surfaces will be cause for rejection.
   4. Back priming: Do not install any trim until backs, edges and other parts not accessible after installation, have been primed. Priming is provided under Section 09 91 00 - Painting.

B. Standing and Running Trim:
   1. All exposed standing and running trim shall be clear grade solid wood, Species as noted, of sizes and shapes indicated on the Drawings.
   2. Trim joinery shall meet the highest standards for quality in accordance with AWI.

3.03 METAL FRAMES

A. Install metal frames items are provided under Section 08 10 20, "Metal Frames".

B. Metal Frames:
   1. Install frames plumb and square. Shim, adjust and anchor as required. Shore and brace frames securely until anchored to adjacent construction; do not attach temporary bracing in a manner that will damage or scar exposed surfaces.

C. Adjusting and Cleaning
   1. Remove rust from scratched areas at job site and touch up primer.
   2. Fill dents with mineral filler, sand smooth and touch-up primer.
   3. Thoroughly clean all exposed surfaces after touch-up and make ready for finish painting.

3.04 PLASTIC FACED DOORS

A. Install plastic faced doors; items are provided under Section 08 15 00, "Plastic Faced Doors and Panels".
B. Do not install doors until wet trade Work is completed and dried, in all areas to receive doors.

C. Condition doors to the average prevailing humidity of the rooms before hanging. Do not subject doors to abnormal or sudden changes in heat, dryness, or humidity.

D. Make all installations in accordance with the best workmanlike practices of the trade. No scuffed or damaged doors will be accepted.

E. Field cutting, trimming, and fitting of prefinished doors will not be permitted.

F. All doors need to be sealed on both end rails before hanging.

G. Protect doors and hardware during construction. Repair marred finishes to perfectly match door surface to the Architect's satisfaction or replace the door.

3.05 FINISH HARDWARE

A. Install finish hardware; items are provided under Section 08 70 00, "Finish Hardware”.

B. The supplier will mark each item of hardware for location. Protect the markings until each item is installed. If any item of hardware is delivered to the job not properly marked, return it to the supplier for marking before attempting to install it.

C. Install and make necessary adjustments for proper working order. Hardware damaged by improper adjustments and careless handling will be rejected.

D. Any hardware damaged by improper adjustment or careless abuse shall be replaced.

E. Fit all surface applied hardware accurately.

F. Metal frames to receive hardware items shall be drilled and tapped accurately.

G. Plastic faced doors to receive hardware items shall have clean, properly sized and accurately placed mortises and drilled holes for all mortise and surface mounted finish hardware. Use appropriate jigs, templates and power mortising equipment for the installation of all mortise hardware items.

H. Secure door closers, exit hardware and other devices surface mounted on plastic faced and hollow metal doors with sex-bolts through door. Attach hardware mounted on metal frames into reinforcements built into frames. If reinforcement is not properly in place, notify Architect before proceeding. Set hardware accurately, adjust for smooth operation and leave in perfect working order.

I. After hardware is installed, protect exposed surfaces by use of heavy paper and masking tape; maintain until job completion.
J. Removal for painting: Remove all hardware, except that which is primed for painting, before painter's finish is applied. Permanently replace and re-adjust for proper function after painter's finish has dried hard.

3.06 BUILDING SPECIALTIES ITEMS

A. Install all items specified under Division 10 - Building Specialties in strict accordance with the manufacturer's directions or as shown on the Drawings.

3.07 CLEAN-UP

A. At the completion of the finish carpentry work, remove all excess materials and rubbish accumulated from this work and leave area clean.

END OF SECTION
SECTION 07 20 00 – BUILDING INSULATION

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1- General Requirements, govern work under this Section whether attached hereto or not.

B. Read all other Sections of the Specifications, which together with the Drawings and this Section describe the Building Insulation work. Verify all dimensions and conditions at the site.

C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRADES

A. Coordinate and cooperate with other trades involved in this project where work of such trades affects or is affected by the work under this Section.

B. Certain items of Building Insulation are to be installed in relation to work of other trades; schedule work, and cooperate in such manner that building insulation items are placed in time to prevent delay of the work to insure proper application; proper installation of these items is the responsibility of this Contractor.

1.03 SCOPE OF WORK

A. Work under this Section of the Specifications consists of the furnishing of all labor, materials, equipment, incidentals and the performance of all operations necessary to complete all Building Insulation work as indicated or reasonably inferred from the Drawings and Specifications. Verify all dimensions and conditions at the job.

B. Work Included:
   1. Sound insulation.

1.04 RELATED WORK

A. Section 09 22 00 – Gypsum Board Assemblies.

1.05 QUALITY ASSURANCE

A. Fire and Insurance Ratings: Comply with fire-resistance, flammability and insurance ratings required and comply with regulations as interpreted by governing authorities. Provide U. L. labels or certification for all materials incorporated in fire resistant assemblies.
1.06 SUBMITTALS

A. Make submittals in accordance with Section 01 33 00.

B. Prior to start of Building Insulation work, submit manufacturer's product data, technical information and installation instructions for each type of material proposed for use.

C. Submit for Architect's approval, sample of each type insulation and accessory proposed for use.

1.07 DELIVERY AND STORAGE

A. Deliver, store and protect materials in accordance with insulation manufacturer's instructions and recommendations.

B. Deliver packaged goods to job in unopened containers or wrappings with manufacturer's labels thereon.

1.08 PROTECTION

A. Protect insulations from physical damage and from becoming wet or soiled. Comply with insulation manufacturer's recommendations for handling, storage and protection at job site.

PART 2 – PRODUCTS

2.01 QUALITY STANDARDS

A. Manufacturers:
   1. Knauf Insulation GmbH
   2. Owens-Corning Fiberglass Corp.
   3. Thermafiber, Inc.

2.02 ACOUSTICAL INSULATION

A. Sound attenuation blankets equal to Knauf Insulation “QuietTherm”, 3 1/2” thick unfaced fiberglass blanket for partitions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 SOUND INSULATION IN PARTITIONS

A. Specified sound attenuation blankets are required in metal stud partitions where indicated on the Drawings.

B. After drywall has been installed on one side of the metal studs, install specified sound attenuation blankets in the stud cavities by friction fitting between studs. Butt ends of blankets closely together and fill all voids. Exercise care to fill around all electrical boxes in walls around structural obstructions, jambs, sills, between deck flutes and plates, etc. as required to provide sound stop.

3.04 CLEAN UP

A. Remove all excess material and/or debris from the project and leave work in a neat and workmanlike manner.

END OF SECTION
SECTION 07 81 00 - SPRAYED FIREPROOFING

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1 - General Requirements, govern work under this Section whether attached hereto or not.

B. Read all other Sections of the Specifications, which together with the Drawings and this Section describe the Sprayed Fireproofing work. Verify all dimensions and conditions at the site.

C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRADES

A. Coordinate and cooperate with other trades involved in this project where work of such trades affects or is affected by the work under this Section.

B. Certain items of Sprayed Fireproofing are to be installed in relation to work of other trades; schedule work and cooperate in such manner that sprayed fireproofing items are placed in time to prevent delay of the work to insure proper application; proper installation of these items is the responsibility of this Contractor.

1.03 SCOPE OF WORK

A. Work under this Section of the Specifications consists of the furnishing of all labor, materials, equipment, incidentals and the performance of all operations necessary to complete all sprayed fireproofing work as indicated or reasonably inferred from the Drawings and Specifications. Verify all conditions at the job.

B. Work Included:
   1. Sprayed fireproofing on structural and miscellaneous steel.
   2. Sealer for exposed fireproofing.

1.04 RELATED WORK

A. Section 05 50 00 – Miscellaneous Steel

B. Section 07 20 00 - Acoustical Insulation

C. Section 09 22 00 - Gypsum Board.
1.05 QUALITY ASSURANCE

A. Comply with fire resistant design requirements as published in the Underwriters Laboratories “Fire Resistance Directory”, published directories of other testing agencies acceptable to the ICC.

B. Fire resistance ratings – Fireproofing material shall be tested and listed for use in Fire Resistant Construction Design which will provide the fire resistance in accordance with the Fire Resistance Rating Schedule as shown on drawings.

C. Applicator for work of this Section shall be an applicator approved by the manufacturer of the fireproofing materials to be installed on this project based on the contractor’s experience and qualifications.

D. Inspection and testing shall be performed continuously to assure that the product is applied to meet the required thickness and resistance to delamination.

E. Acceptable manufactures:
   1. Isolaték International
   2. Southwest Fireproofing Products
   4. Pyrok, Inc.

1.06 SUBMITTALS

A. Make submittals in accordance with Section 01 33 00.

B. Submit for Architect's review, manufacturer's specifications and installation instructions for type of spray fireproofing proposed for use. Include all data substantiating that the materials comply with specified requirements and a schedule for fireproofing including the building elements to be protected, hourly rating requirements and fireproofing thickness to the applied.

C. Submit a schedule of ASTM E119 fire resistive designs from the “Fire Resistive Directory” by UL or other qualified testing agencies to meet the Fire Resistive Ratings scheduled for the project.

1.07 DELIVERY AND STORAGE

A. Deliver, store and protect materials in accordance with manufacturer's instructions and recommendations.

B. Materials shall be delivered to job site in original containers, bearing proper Underwriters' Laboratories, Inc. labels. Store materials in a dry place, off the ground and away from all material subject to sweating or other dampness.
1.08 SEQUENCING AND COORDINATION

A. Integrate scheduling and coordination of fireproofing work with other items of work so that fireproofing will not be exposed to weather and other damaging conditions; will not be unnecessarily exposed to abrasion and other damage likely to occur during subsequent work; will be installed prior to installation of enclosing or concealing work; will provide time allowance for inspection and testing and subsequent correction of defective fireproofing; and will minimize time the work to be protected by fireproofing is exposed to possible fire hazards.

PART 2 - PRODUCTS

2.01 QUALITY STANDARDS

A. Fireproofing materials shall be as specified herein and shall bear UL Label. Substitution of other type and manufacture of material may be made only upon Architect's written approval. Materials used for patching and repairs must be compatible with the existing fireproofing materials.

B. CAFCO FIBER-PATCH is a hand applied fire protection material designed for patching damaged spray-applied fire resistive materials. It is classified by Underwriters Laboratories, Inc. in all UL designs listing CAFCO BLAZE-SHIELD Type DC/F, BLAZESHIELD Type II for areas up to 432 sq. in.

C. Miscellaneous Materials: Provide accessories needed or required for proper installation in compliance with fireproofing material manufacturer's printed instructions.

D. Water: Clean, taken from domestic supply and suitable for human consumption.

E. Sealer: All existing and patched areas of fireproofing that are scheduled to be painted shall receive a coating of Bond-Seal EBS, a transparent-drying, water-dispersible, tinted protective coating (black tinted). Use as recommended by fireproofing manufacturer.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine substrate and conditions under which the insulation work is to be performed and notify the Contractor in writing of any unsatisfactory conditions. Do not proceed with the fireproofing work until unsatisfactory conditions have been corrected in manner acceptable to the installer.
B. Temperature: In cold weather, the temperature of the building shall be maintained above 45 degrees F. for an adequate period prior to the application of fireproofing, while the fireproofing is being done and until the material is dry.

C. Surfaces of the steel shall be clean and free of dirt, oil, grease, dust, loose paint, loose mill scale and any other condition that would prevent good adhesion of the fireproofing plaster. Commencement of work shall imply acceptance of steel surfaces by the Contractor.

D. If needed, rolling or tamping flat surfaces of the base material prior to applying CAFCO Bond-Seal may be needed to provide a smooth surface appearance for finished work.

E. All clips, hangers, supports, sleeves and other attachments to the fireproofed bases shall be in place prior to the application of the fireproofing material.

3.02 APPLICATION

A. Fireproofing material shall be mixed with water by mechanical mixer, which is clean, and free of previously used materials. Material shall not be retempered. Proportions of the mix and mixing time shall be in accordance with the manufacturer's directions.

B. Apply CAFCO FIBER-PATCH in multiple layers until the patch is at the required thickness as indicated in the applicable UL design. Allow time for setting of one layer before applying the next. Never mix more FIBERPATCH than can be installed in 30 minutes. FIBER-PATCH is a setting material, DO NOT retemper material once it has set.

C. CAFCO Bond-Seal is to be sprayed applied to provide a smooth surface for additional paint (finish) adhesion. Exercise special care and provide such forms of protection as necessary to prevent over-spray onto adjacent surfaces.

3.03 CLEANING

A. Clean up and remove daily from the job site all rubbish and debris resulting from the work of this Section and continuously maintain the premise in a clean, orderly condition.

B. Upon completion of the work of this Section remove all rubbish, tools, equipment and unused materials of the work of this Section from the job site.

END OF SECTION
SECTION 07 90 00 - SEALANTS

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1 - General Requirements, govern work under this Section whether attached hereto or not.

B. Read all other Sections of the Specifications, which together with the Drawings and this Section describe the Caulking and Sealing work. Verify all dimensions and conditions at the site.

C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRADES

A. Coordinate and cooperate with other trades involved in this project where work of such trades affects or is affected by Caulking and Sealing work.

B. Certain items of Caulking and Sealing are to be installed in relation to work of other trades; schedule work, and cooperate in such manner that caulking and sealing items are placed in time to prevent delay of the work to insure proper application; proper installation of these items is the responsibility of this Contractor.

C. Examine all surfaces prepared by other trades to receive Caulking and Sealing work; report any conditions considered detrimental to proper installation and performance; make report in writing to Architect in ample time to allow correction without delaying the project. Application of Caulking and Sealing will be construed, as acceptance of surfaces and corrections of defects or imperfections shall be made by this Contractor as directed by the Architect, at no expense to the Owner.

1.03 SCOPE OF WORK

A. Work under this Section of the Specifications consists of the furnishing of all labor, materials, equipment, incidentals and the performance of all operations necessary to complete all Caulking and Sealing work as indicated or reasonably inferred from the Drawings and conditions at the job.

B. Work Included:
   1. Caulking and sealing.
   2. Back up materials and primers.

1.04 RELATED WORK

A. Section 09 22 00 – Acoustical Sealants in Partitions
1.05 QUALITY ASSURANCE
A. Applicator Qualifications - A firm, which has specialized for not less than five years in installation of type of sealants and caulking required for this project.

B. Fire-Resistance Rating: Where floors, wall and partition systems with fire resistance ratings are indicated or are required to comply with governing regulations, provide materials and installations identical with applicable assemblies which have been tested and listed by UL or other recognized authorities.

C. Refer to U.L. Assembly noted on the drawings for additional product information for floor, ceiling and partition systems and penetrations.

1.06 SUBMITTALS
A. Make submittals in accordance with Section 01 33 00.

B. Prior to start of sealant and caulking work, submit manufacturer's product data, technical information and installation instructions for each type of material proposed for use, and samples of manufacturer's colors.

C. If requested, submit for Architect's approval, sample of each type materials proposed for use.

1.07 DELIVERY AND STORAGE
A. Deliver, store and protect materials in accordance with product manufacturer's instructions and recommendations.

B. Deliver packaged goods to job in unopened containers or wrappings with manufacturer's labels thereon.

1.08 JOB CONDITIONS
A. Protection of Finish Work - Protection of adjacent surfaces and finish work from damage due to caulking and sealing operations is responsibility of this Contractor. Remove any spotting, stains, smears and make good any damage resulting from this work as directed by the Architect at no expense to the Owner.

PART 2 - PRODUCTS
2.01 QUALITY STANDARDS
A. Sealants and caulking
   1. Sealant:
      a. Compounds for all sight exposed joints, and at other locations referred to on the Drawings as "sealant" shall be:
         (1) Polysulphide: two component, Type 1, A&B conforming to F.S. TT-2230 or TT-S-227b, bearing Thiokol Corp. seal of approval.
(2) Urethane: one or two part polyurethane polymer, Type II, Class A, conforming to F.S. TT-S-00230C or TT-S-00227E.

b. Acceptable manufacturers of products meeting the above requirements:
   (1) Sonneborn Building Products, Inc.
   (2) Pecora, Inc.
   (3) W.R. Grace & Co.
   (4) Euclid Chemical Co.

c. Sealants shall cure or polymerize by solvent release, moisture absorption, or catalyst.

d. Primer shall be provided at all joints requiring sealant. Primers shall be as specifically recommended by sealant manufacturer.

e. Colors (not standard colors) shall be as selected by Architect.

2. Caulking compound:
   a. Caulking compound for use at concealed locations, not referred to as “sealant” shall be standard caulking compound, watertight, gun consistency, conforming to FS TT-C598, grade 1, as manufactured by:
      (1) Sonne Building Products, Inc.
      (2) Pecora, Inc.
      (3) Tremco Mfg. Co.
      (4) Euclid Chemical Co.

3. Fire rated Sealants for assembly perimeter and penetrations, equal to USG. Refer to U.L. Assembly noted on the drawings for additional product information.
   a. "Acrylic Firestop Sealant – Type A”.
   b. "Intumescent Acrylic Firestop Sealant – Type 1A”.
   c. "Acoustical Sealant – Type AS”.

B. Joint Backing:
   1. Backer rod for dynamically moving joints shall be highly compressible rod stock of closed-cell polyethylene foam, butyl rubber, or non-bleeding neoprene foam, compatible with type of sealant provided.
   2. Joint backing for fully concealed, non-moving joints, for air and water seal (e.g. bedding of sills, sealing or interior pipe penetrations thru walls and floors, etc.) and generally referred to as caulking compound joints shall be untreated oakum, rope yarn or open cell polyethylene foam.
   3. Forming Material for fire rated assemblies (if required by system): Nominal 4lb./cu.ft. mineral wool insulation, unfaced, 4” thick.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Preparation:
   1. Before applying caulking or sealant to new or existing materials, rake out all existing sealant, caulk, backer rods, etc.; clean all surfaces to receive this material, free of dirt, grease or other foreign matter.
   2. Apply caulk or sealant at all joints where dissimilar materials intersect or overlap.
   3. Set the depth of back-up material at the 1/2 joint width from surface (not to exceed 1/2” deep). Apply primers as recommended by compound manufacturer.

B. Sealant:
   1. Seal perimeter of openings, joints between dissimilar materials, control joints and other locations on interior where sealant or caulking is required to produce a weathertight, light-tight neat joint.
2. Manufacturer's directions shall be followed closely in mixing and applying the base compound and curing agent. Compound shall be applied with air gun to form flexible sealed joints. Mask off as necessary to provide neat, even application. Apply primer prior to sealant application where surface conditions require.

3. Do not disturb compound by touching, washing, or otherwise until it has cured tack free (24-36 hours).

4. Excess compound shall be removed from surfaces after curing.

5. Properly “tool” all joints and smooth uneven surfaces with soft brush and appropriate solvent as recommended by manufacturer.

C. Caulking:
1. Apply caulking under sills, behind frames, at pipe penetrations thru floors and walls, and at concealed joints. Provide full bed of caulk or otherwise as required to insure tight construction.

2. Apply compound with gun of proper nozzle size in accordance with compound manufacturer's directions. Use sufficient pressure to fill all voids and joints solid. Do not apply compounds when temperature is below 40 degrees F. Properly “tool” all joints.

D. Fire Rated Sealant
1. Place required sealant around all penetrations through or in partitions or floors (new or existing) by conduit, pipe, ductwork, rough-in boxes, and similar items. The specific system will determine the necessary amount of forming material and permitted joint or annular space. Refer to U.L. Assembly requirements for additional/specific installation information. Contact the Architect for existing conditions encountered during construction not called out on the drawings.

E. Upon completion, joint surfaces shall be smooth, even and watertight. Complete work before final coat of paint. After surface has cured, remove any and all material used in dressing joints which would interfere with paint adherence.

3.02 WARRANTY

A. The Sub-Contractor for this Section shall give the Owner a written warranty against water leaks that may occur through any joints caulked or sealed by this Section. This warranty shall be for a period of two years from the date of acceptance of the work by the Owner, and shall provide that this Contractor, at his own expense, will do all work and provide all materials necessary to correct any such leaks that may occur.
SECTION 08 10 20 - METAL FRAMES

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1 - General Requirements, govern work under this Section whether attached hereto or not.

B. Read all other Sections of the Specifications, which together with the Drawings and this Section describe the Metal Frame work.

C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRADES

A. Coordinate and cooperate with other trades involved in this project where the work of such trades affects or is affected by the work under this Section.

B. Schedule and coordinate work with other trades to provide close jointing and fitting with adjoining materials and to prevent conflicts and delays.

1.03 SCOPE OF WORK

A. Work under this Section of the Specifications consists of the furnishing of all labor, materials, equipment, incidentals and the performance of all operations necessary to complete all Metal Frame work as indicated or reasonably inferred from the Drawings and Specifications.

B. Work Included:
   1. Metal frames.

1.04 RELATED WORK

A. Section 08 70 00 - Finish hardware.

B. Section 09 91 00 - Field painting of metal frames.

1.05 QUALITY ASSURANCE

A. As a minimum and as applicable, comply with the following:
   1. ASTM A-366 - Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
   2. ASTM A-924 - Steel Sheet, Zinc Coated (Galvanized) by the Hot Dip Process, General Requirements.
   4. ASTM A-653 - Steel Sheet, Cold-Rolled, Electrolytic Zinc Coated.
   5. Underwriters' Laboratories, Inc. (UL) and Factory Mutual (FM), as applicable to fire-rated steel frames.
B. Uniformity - Provide frames as produced by one manufacturer unless otherwise approved.

C. Acceptable manufacturers:
   1. CeCo Corporation.
   2. Pearland Industries.
   3. Curries Company

1.06 SUBMITTALS

   A. Make submittals in accordance with Section 01 33 00.

   B. Prior to start of fabrication, submit:
      1. Frame manufacturer's product data, specifications and installation instructions.
      2. Shop drawings showing or scheduling each door's location, size, thickness, details of construction, location and installation requirements of finish hardware and reinforcements. Schedule of door frames shall be prepared using same reference numbers for openings and details as those used on contract drawings.

1.07 DELIVERY, STORAGE AND HANDLING

   A. Deliver frames cartoned or crated to provide protection during transit and job storage.

   B. Inspect frames upon delivery for damage. Minor damages may be repaired provided finished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

   C. Store frames at building site under cover and in manner that will avoid rust and damage. Avoid use of non-vented plastic or canvas shelters, which could create humidity chamber.

PART 2 - PRODUCTS

2.01 QUALITY STANDARDS

   A. Frames
      1. Materials: Frames for interior openings shall be either commercial grade, cold-rolled steel conforming to ASTM A-366 or commercial grades hot rolled and pickled steel conforming to ASTM A-569. Metal thickness shall be not less than 16 gauge for frames at openings 4'-0" or less in width and not less than 14-gauge for frames at openings over 4'-0" in width and shall receive a galvannealed (zinc coated) A60 coating.
      2. Design and Construction
         a. Frames shall be custom made, welded units with integral trim of sizes and shapes shown on approved shop drawings.
         b. Frames shall be strong and rigid, neat in appearance, square true and free of defects, warp and buckle. Molded members shall be clean cut, straight and have uniform profile throughout their length.
         c. Jamb depths, trim, profile and backbends shall be as shown on approved shop drawings.
d. Corner joints shall have contact edges closed tight, with trim faces mitered and continuously welded, and stops butted. The use of gussets shall not be permitted.

e. Minimum depth of stops shall be 5/8".

f. Hardware reinforcements:
   1.) Frames shall be mortised, reinforced, drilled and tapped at factory for fully templated mortised hardware in accordance with approved hardware schedule and templates provided by Section 08 70 00. Where surface-mounted hardware is to be applied, frames shall have reinforcing plates only.
   2.) Minimum thickness of hardware reinforcing plates shall be as follows:
      (a) Hinge and pivot reinforcements (1-1/4" x 10" minimum size): 7-gauge.
      (b) Reinforcements for strike, flush bolts, closers, surface-mounted hardware and panic devices: 12-gauge.

g. Floor anchors - shall be securely welded inside each jamb, with holes for floor anchorage.

h. Jamb anchors:
   1.) Frames for installation in wood or metal stud partitions shall be provided with four (4) steel anchors of suitable approved design, not less than 16-gauge thickness, securely welded inside each jamb. <or as follows:
      (a.) Frames up to 7'-6" height - 4 anchors.
      (b.) Frames 7'-6" to 8'-0" height - 5 anchors.
      (c.) Frames over 8'-0" height - 4 anchors plus one additional for each 2' or fraction thereof over 8'-0".

i. Dust cover boxes of not less than 26-gauge steel shall be provided at all mortised hardware items.

j. Frames shall be provided with steel spreader temporarily attached to bottoms of both jambs for bracing during shipping and handling.

B. Finish:
   1. Shop paint steel (whether galvanized or ungalvanized) and steel accessories as follows:
      a. Clean surfaces free of mill scale, rust, oil, grease, dirt and other foreign matter.
      b. Chemically treat surfaces to insure maximum paint adhesion and apply one coat of an approved baked-on rust-inhibitive primer paint to provide a minimum 0.5 mil dry film thickness.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Furnish to Section 06 40 00 for installation.

END OF SECTION
SECTION 08 15 00 - PLASTIC FACED DOORS

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1 - Special Requirements, govern work under this Section whether attached hereto or not.

B. Read all other Sections of the Specifications, which together with the Drawings and this Section describe the Plastic Faced Door work.

C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRADES

A. Coordinate and cooperate with other trades involved in this project where the work of such trades affects or is affected by the work under this Section.

1.03 SCOPE OF WORK

A. Work under this Section of the Specifications consists of the furnishing of all labor, materials, equipment, incidentals and the performance of all operations necessary to furnish all Plastic Faced Doors as indicated or reasonably inferred from the Drawings and Specifications.

B. Work Included:
   1. Plastic laminate faced doors and transom panels, non-rated.

1.04 RELATED WORK

A. Section 06 40 00 - Installation of Doors

B. Section 08 10 20 - Metal Frames

C. Section 08 70 00 - Finish Hardware

1.05 QUALITY ASSURANCE

A. As a minimum and as applicable, comply with the following:

B. Uniformity - Provide doors as produced by one manufacturer unless otherwise specified or approved.
C. Acceptable manufacturers:
   1. Graham Wood Doors
   2. Tex-Lam Manufacturing Inc.
   3. VT Industries, Inc.

D. Warranty - Doors and panels shall be warranted for lifetime of installation against defects in material and workmanship in accordance with the Standard Door Guarantee of the National Woodwork Manufacturer's Association.

1.06 SUBMITTALS

A. Make submittals in accordance with Section 01 33 00.

B. Prior to start of fabrication, submit:
   1. Door manufacturer's product data, specifications and installation instructions for each type of door proposed for use.
      a. Include details of core and edge construction.
      b. Include certifications as required to show compliance with specifications.
   2. Shop drawings showing or scheduling location, size, thickness, elevation, details of construction, location and extent of hardware blocking and other pertinent data for each plastic faced door required.
   3. Samples of plastic laminate colors and patterns for Architect's selection.
   4. Written guarantee that any of the following shall be cause for rejection and that rejected doors will be promptly replaced with new acceptable doors:
      a. "Photographing" of core.
      b. Imperfections, which show in finished door.
      c. Warp, bow, cup or twist in excess of NWMA or AWI standards for each type of door furnished.

1.07 PRODUCT HANDLING

A. Protect doors from weather and all other damaging conditions until Final completion of building by the Owner.

B. Store doors undercover in a dry location. Do not store or install doors in areas that are not closed in or in areas where masonry, concrete, plaster and cement finishes are not dry.

C. Doors with scratched faces; chipped corners, dented edges or delaminated faces will be rejected.

PART 2 - PRODUCTS

2.01 QUALITY STANDARDS

A. Door Types: (Refer to door schedule for type locations):
   1. Solid Core - AWI Type PC-HPDL-5, 1-3/4" thick, flush, solid core (particleboard) with decorative laminate covering on both faces.
B. Door Construction
   1. Core - Particleboard, ANSI A208.1, grade 1-LD-1.
   2. Stiles - Minimum 1-1/4" before trimming, one or two pieces, glue to core prior to sanding, preservative treated hardwood and sealed.
   3. Top and Bottom Rails – Minimum 1 1/8” before field fitting, one piece or laminated, glue to core prior to sanding preservative treated hardwood and sealed.
   4. Faces and Edges- GP-50 (0.050) high pressure decorative plastic laminate complying with FS L-P-508G, Style D, Type I, Class 1 or NEMA Standard LDI, Type I general purpose laminates.
   5. Adhesive - AWI Type I, thermosetting water-resistant adhesive.

C. Panels
   1. Panels, where indicated, shall be identical in construction to the door over which installed and decorative veneers shall be end matched, each face.
   2. Panels shall have matching edge banding on bottom edge, rabbet to receive rabbet of door.
   3. Panels shall be manufactured by same manufacturer as door.

2.02 FABRICATION

A. Obtain all required job measurements to assure proper manufacture of doors to fit job conditions. Particularly coordinate work with work of other Sections of the Specifications that provide doorframes or items that will be installed in and on doors.

B. Schedule door deliveries to the site to meet job schedules for glazing installation, hanging and locking, sealing and painting of edges.

C. Provide astragals for double doors where center frame mullions are not provided.

D. Bevel strike edge of doors 1/8 inch in 2 inches.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Furnish to Section 06 40 00 for installation.

END OF SECTION
SECTION 08 70 00 - FINISH HARDWARE

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1 - Special Requirements, govern work under this Section whether attached hereto or not.

B. Read all other Sections of the Specifications, which together with the Drawings and this Section describe the Finish Hardware work.

C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRades

A. Cooperate and coordinate with other trades involved in this project where work of such trades affects or is affected by Finish Hardware.

B. Schedule and coordinate work with other trades to provide close joining and fitting with adjoining materials and to prevent conflicts and delays.

1.03 SCOPE OF WORK

A. Work under this Section of the Specifications consists of furnishing Finish Hardware items as required to complete the work, except for hardware items provided under other Sections.

B. All existing door hardware will be salvaged for re-use in this project. All hardware will be inventoried by the Contractor for consideration of location/use in each hardware set. The Contractor will remove all damaged/unused hardware items at the completion of the project.

C. Work shall include, but not necessarily be limited to, the following:
   1. Butt hinges
   2. Lock sets
   3. Panic Devices
   4. Door closers
   5. Kick plates
   6. Stops
   7. Silencers
   8. Sound Seals

1.04 RELATED WORK

A. Section 06 10 00 - Rough hardware items.

B. Section 06 40 00 - Installation of finish hardware items, unless otherwise required.
C. Section 07 90 00 - Sealants

D. Section 08 10 20 - Factory preparation of metal frames to receive finish hardware items.

E. Section 08 15 00 - Plastic Faced Doors.

1.05 GENERAL CONSIDERATIONS

A. Order no hardware prior to Architect's approval of schedule and samples.

B. Work of this Section shall comply with applicable requirements of the Texas Architectural Barriers Act, as identified in the Texas Government Code, Chapter 469, Elimination of Architectural Barrier and with the Americans with Disabilities Act (ADA).

C. On receipt of hardware and templates at the job. The General Contractor shall store and protect hardware from loss, theft, or damage. Cartons shall be code marked by the supplier for installation in the proper location in accordance with the approved hardware schedule. When removing hardware to allow for painting and finishing, the Contractor shall code and store items to insure proper location.

1.06 SUBMITTALS

A. Make submittals in accordance with Section 01 33 00.

B. Prior to ordering materials, submit:
   1. Product manufacturer's printed specifications and installation instructions.
   2. Submittals to include manufacturer's product data, finishes and installation details.
   3. Samples of:
      a. Metal finishes.
      b. Accessories, hardware, if requested; samples may be used in the work if acceptable.

PART 2 - PRODUCTS

2.01 QUALITY STANDARDS

A. Quality: Hardware shall be of uniform color and free from imperfections affecting the appearance and serviceability. It shall be suitable and adapted for its required use and shall fit its respective location.

B. Fasteners: Bolts, screws and appurtenances, for the application of hardware, shall be of the size and type to fit requirements and shall be in harmony with the hardware as to material and finish. Exposed screws shall have countersunk oval heads where possible, and bolts shall have cap nuts. The countersunk part of all screw holes shall form a good seat for the screw heads, with no sharp edges at the back.
C. TAMU Requirements:
1. All locksets and keying must match what is already in place in the existing building. Contact Texas A&M University, Building Access Department for correct hardware that MUST be installed. Any hardware installed that was not previously approved by TAMU Building Access that does not match existing will not be accepted by the University until that hardware has been replace with what is appropriate for the building.
2. Mortise locks shall meet ANSI A256.13 Series 1000, Grade 1 Operational and Grade 2 Security. Listed by Underwriters laboratory for use on 3 Hour label doors. Lock case and face plate dimensions fit standard door preparation as specified in ANSI A115.1. Locksets and Latch-sets must have the ability to change handling without opening the case. Other requirements are as follows: Satin stainless-steel No. 626 or 630 finish. One-inch stainless steel throw deadbolt. 3/4 inch throw anti-friction latch bolt standard.
3. Cylinders for locks shall utilize seven pin, key removable cores. Cores shall be existing to be salvaged for re-use.
4. The TAMU Building Access Department will be responsible for changing out the construction cores with the permanent cores and for returning construction cores to building Contractor.

2.02 HARDWARE SCHEDULE

A. General
1. Contractor shall prepare and submit a detailed schedule of finish hardware for Architect's approval. Each item listed in hardware schedule shall be assigned consecutive numbers and shall be identifiable with respect to manufacturer, brand, catalog numbers, materials, finish, dimensions and operations, as well as location and use in the building.
2. Architect will check Hardware Schedule for quality types only. The Contractor shall be solely responsible for the quantities, functions, errors, omissions, and conformance with this Specification.
3. Verify that all new and existing door closers meet the maximum pull requirement for handicap accessibility. Adjust all as needed.
4. The schedule below is intended to indicate the general quality and type of hardware required for particular opening listed, but such a description or schedule shall not be construed to denote that no other items of hardware will be required for this project.
5. NOTE: The contractor shall visit the sites before the bid date and inspect all relative site conditions. All lockset shall be interchangeable core (IC). Keypath profile shall match existing system. For keying questions contact TAMU Building Access Supervisor, Ronnie Shultz at (979) 458-1335.

B. Catalog References: Reference numbers listed in the Hardware Schedule that follows, have been taken from catalogs of the following manufacturers:

<table>
<thead>
<tr>
<th>Mfgr.</th>
<th>Mark</th>
<th>Cat. No.</th>
<th>Size/Design</th>
<th>Finish</th>
<th>Description</th>
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<tr>
<td>HINGES</td>
<td></td>
<td>BB1279</td>
<td>4 1/2&quot; x 4 1/2&quot;</td>
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Finish Hardware – 08 70 00.3
1857
### CLOSERS (LCN or Sargent)

<table>
<thead>
<tr>
<th>Set No.</th>
<th>Description</th>
<th>Door Number(s)</th>
<th>Quantity</th>
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<td>C-1</td>
<td>4040XP AL CLOSER</td>
<td>103, 104, 108</td>
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<td>C-2</td>
<td>EXISTING RE-USE</td>
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<td>2 EA.</td>
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<td></td>
<td></td>
<td></td>
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<td>E-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 EA.</td>
<td>S-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 EA.</td>
<td>K-2</td>
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### LOCKS (Sargent)

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### EXIT DEVICES (Sargent)

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<th>Hdwr. Mark</th>
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### FLAT GOODS

### ROCKWOOD

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<td>442 ES</td>
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<td>K-1</td>
<td>K1050WS 40&quot; x 34&quot;</td>
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<td>32D</td>
<td>ARMOR PLATE</td>
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<td>K-2</td>
<td>EXISTING KICK DOWN DOOR STOP</td>
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<td>RE-USE</td>
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<tr>
<td>F-1</td>
<td>557 1&quot; x 6 ¾&quot;</td>
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### C. Door Sets

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<td>2 EA.</td>
<td>C-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 EA.</td>
<td>E-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 EA.</td>
<td>S-2</td>
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<td>K-2</td>
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<tr>
<td>2.</td>
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<td>L-1</td>
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<tr>
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<td></td>
<td>2 EA.</td>
<td>F-1</td>
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<tr>
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<td>2 EA.</td>
<td>S-2</td>
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<td>K-1</td>
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<td>3.</td>
<td>STORAGE</td>
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<td>C-2</td>
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<tr>
<td></td>
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<td>3 EA.</td>
<td>S-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 EA.</td>
<td>S-2</td>
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</tbody>
</table>
**PART 3 - EXECUTION**

**3.01 INSTALLATION**

A. Coordination: Obtain all information required to provide correct hardware for each application such as size, shape, bevel and thickness of doors and frames, the swing or doors, and the relationship of hardware to all adjoining work.

B. Protection: Knobs, handles and pulls shall be provided with cloth or cotton covered paper coverings, of sufficient size to completely cover the items, secured to remain in place during construction.

C. Completed Work: Hardware shall be in perfect condition in all respects, perform its intended function and operate smoothly. Defective hardware provided under this section shall be replaced at no cost to the Owner. Upon completion, deliver to Owner two copies of approved finish hardware schedule and keying schedule, together with one set of clearly marked installation tools and templates.

D. Furnish to Section 06 40 00 for installation.

**END OF SECTION**

<table>
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<tr>
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<td>3 EA.</td>
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<td>1 EA.</td>
<td>S-2</td>
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<td>K-1</td>
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<table>
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<td>3 EA.</td>
<td>S-1</td>
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<td></td>
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<td>1 EA.</td>
<td>S-2</td>
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</tbody>
</table>
SECTION 09 22 00 - GYPSUM WALLBOARD

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1 - General Requirements, govern work under this Section whether attached hereto or not.

B. Read all other Sections of the Specifications, which together with the Drawings and this Section describe the Gypsum Wallboard work.

C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRADES

A. Cooperate and coordinate with other trades involved in this project where work of such trades affects, or is affected by, Gypsum Wallboard.

B. Schedule and coordinate work with other trades as not to cover up work in progress and to prevent conflicts and delays.

1.03 SCOPE OF WORK

A. Work under this Section of the Specifications consists of the furnishing of all labor, materials, equipment, incidentals and the performance of all operations necessary to complete all Gypsum Wallboard work as indicated or reasonably inferred from the Drawings and Specifications.

B. Work Included:
   1. Metal framing for gypsum board construction.
   2. Gypsum wallboard.
   3. Acoustical sealant.

1.04 RELATED WORK

A. Section 07 20 00- Sound Insulation

B. Section 09 51 00 - Acoustical Ceiling

C. Section 09 91 00 - Painting
1.05 QUALITY ASSURANCE

A. As a minimum and as applicable, comply with local code requirements and the following:
   1. ASTM C-754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard, Backing Board, or Water-Resistant Backing Board.

B. Fire-Resistance Rating: Where gypsum wallboard systems with fire resistance ratings are indicated or are required to comply with governing regulations, provide materials and installations identical with applicable assemblies which have been tested and listed by UL or other recognized authorities. Refer to U.L. Assembly noted on the drawings for additional product information for floor, ceiling and partition systems and penetrations.

C. Manufacture: To the maximum extent possible, obtain gypsum board products and accessories from one manufacturer or from manufacturers recommended by the manufacturer of the gypsum board used. Products and materials are designated by United States Gypsum numbers and brand names except as noted. Other acceptable manufacturers are:
   1. Gypsum Board and Related products:
      a. American Gypsum, Dallas, TX.
      b. G-P Gypsum Corporation, Atlanta, GA.
      c. National Gypsum Company, Charlotte, NC.
   2. Steel Framing and Furring:
      a. Clark Steel Framing Systems, Dallas, Texas.
      b. Delta Metal Products, Dallas, Texas.

D. Allowable Tolerances: Do not exceed 1/8" offset between planes of adjacent board faces nor 1/4" in 8 ft. for plumb, level, warp and bow.

1.06 SUBMITTALS

A. Make submittals in accordance with Section 01 33 00.

B. Submit manufacturer's product specifications and installation instructions for gypsum wallboard systems required, including other data as may be required to show specification compliance.

C. Submit samples of gypsum wallboard accessories proposed for use, if requested by Architect.
1.07 PRODUCT HANDLING

A. Deliver, identify, store and protect gypsum wallboard materials to comply with GA G-216 and material manufacturer's recommendations.

B. Gypsum wallboard products and materials shall be kept covered and protected from weather and other damaging conditions at all times while in transit and after receipt at the site. Store materials in dry locations where they will not be subjected to wetting and moisture absorption.

1.08 JOB CONDITIONS

A. Environmental Conditions: Comply with GA G-216.

PART 2 - PRODUCTS

2.01 METAL FRAMING SYSTEMS

A. For partitions and for wall and column furring:
      b. Interior ceiling framing and furr downs – (1-3/8” face) 25-gauge (18 mils) in 1-5/8”, 2-1/2”, 3-5/8” and 6” widths spaced as needed for spans.
   2. Wall furring - ASTM C-645, 22 gauge (0.03125 inch thick), galvanized, hat-shaped 2-3/4" x 7/8" (1-3/8" face). Provide resilient type where noted.
   3. Anchors - as recommended by stud manufacturer for attachment to floors and to structure above.
   4. Stud system accessories:
      a. Stud manufacturer's standard clips, shoes, ties, reinforcements, fasteners and other accessories required or as approved.
      b. Provide “Deep” vertical deflection clip or track assembly, 3” Leg.
      c. 1 1/2" cold rolled channels, 16 gauge (0.0625 inch thick), galvanized.
      d. 1 1/2", 20 gauge (0.0375 inch thick) galvanized steel strap.

2.02 GYPSUM WALLBOARD PRODUCTS

A. Gypsum wallboard:
   1. Types:
      a. Standard - ASTM C1396, DensArmor, mold/moisture resistant gypsum panels tapered long edges, 5/8" thick unless otherwise indicated; use maximum lengths possible to avoid horizontal joints.

B. Trim and Accessories:
   1. Metal Trim
b. Discontinuous edges - galvanized steel, 200 series, “L” or “J” trim.
c. Control Joints - No. 093, galvanized flanges.
2. Gypsum Board Fasteners:
   a. For metal framing - "Type S", bugle head, lengths as recommended by manufacturer.
3. Joint Treatment - Perforated tape and joint compound supplied by gypsum wallboard manufacturers.

2.03 MISCELLANEOUS MATERIALS

A. Sealants for assembly perimeter and penetrations.
   1. Acoustical - Equal to USG "Acoustical Sealant".
   2. Forming Material (if required by system): Nominal 4 lb./cu.ft. mineral wool insulation, unfaced, 4" thick.

PART 3 - EXECUTION

3.01 METAL FRAMING ERECTION, GENERAL

A. Erect metal framing in accordance with ASTM C-754.

B. Install members true to lines and levels to provide surface flatness with maximum variation of 1/8" in 10 feet in any direction.

C. Install supplementary framing, blocking and bracing to support fixtures, equipment, services, heavy trim, furnishings and similar work which cannot be adequately supported on gypsum wallboard alone.

3.02 METAL STUD ERECTION

A. Install runner tracks at floors, ceilings and structural walls and columns as shown or directed with suitable fasteners spaced not more the 24" o.c. Set runners in sealant material if framing is included in a rated system.
   1. Studs shall be secured to continuous runner tracks unless the stud end terminates at deflection track.
   2. Installation of track at primary structure framing shall accommodate vertical displacement of (1 1/2") of the primary frame. This shall include side clips and deflection slip tracks as shown on the Drawings.
   3. Framing of wall openings shall include headers and jambs as shown on the Drawings.

B. Position studs in track on 16" centers by rotating into place for a friction fit. Provide double studs on both sides of every opening. Provide double studs at all control joint locations. Secure studs located at openings, partition intersections and corners with 3/8" sheet metal screws through both flanges of studs and tracks.
C. Provide additional bracing as required to support interior stud walls (refer manufacturer span tables). Provide lateral and diagonal bracing as required by installing strap bracing, fastened to each stud flange or cold rolled channels inserted through stud web holes and secured by screws or welding - refer to stud manufacturer written recommendations for conditions encountered.

D. Provide blocking or special framing where required or indicated to receive anchoring for items to be supported from or built to partitions or other wallboard framing systems.

E. Coordinate installation of bucks, anchors, blocking, electrical and mechanical work which is to be placed in or behind wallboard framing. Arrange for such items to be installed after framing is complete. Studs shall be securely anchored to jamb and head anchor clips of each frame by bolt screw attachment.

3.03 WALL AND COLUMN FURRING INSTALLATION

A. Erect wall furring attached as shown.

B. Erect furring channels horizontally unless otherwise shown or approved (vertically preferred on direct attachment to concrete or masonry surfaces). Secure in place on alternate channel flanges at maximum 16 inches on center.

C. Space furring channels maximum 24 inches on center, not more than 4 inches from floor and ceiling lines.

D. Erect freestanding metal stud furring (furr downs) by means of adjustable furring brackets secured to structural supports in accordance with manufacturer's directions. Provide diagonal bracing as required (48" o.c. maximum).

E. Erect column furring as shown or directed.

3.04 GYPSUM WALLBOARD INSTALLATION

A. Install gypsum wallboard in accordance with recommendations of GA-216.

B. Wallboard
   1. Erect single layer standard gypsum wallboard in direction most practical and economical, with joints staggered on opposite sides of partitions, ends and edges occurring over solid bearing.
   2. Install sound attenuation blankets when installing gypsum board assemblies
   3. Use Type S screws when fastening gypsum wallboard to metal furring and framing.
   4. Place control joints as shown or at approximately 20'-0" o.c., and consistent with lines of building spaces. Break wallboard behind joint using double studs. Provide control joints on both sides above door frames and both sides of the partition and approximately 20'-0" o.c.

C. Ceiling Board
   1. Install ceiling board with end joints staggered in alternate rows.
2. Provide control joints at approximately 20'-0" o.c. (400 SF Max) or as shown on the Drawings.

D. Trim
1. Install control joints to face layer with staples spaced 6" o.c. on both flanges along entire length of joint.
2. Place corner beads at external corners. Use longest practical lengths. Place edge trim at exposed edges, at discontinuous edges, where gypsum wallboard abuts dissimilar materials and at locations as shown.

E. Metal Frames: Coordinate work with that of Division 08 10 20 - Metal Frames, to provide proper setting and anchoring of metal frames.

F. Bedding and Taping:
1. Bed and tape all joints throughout the project in compliance with ASTM C-475. Unless noted elsewhere, a Level 4 finish will be required on all finished gypsum board surfaces, refer GA-214.
2. Float joints, screw heads and trim flanges.
3. Provide a thin uniform coat of joint compound, 3" to 6" wide, and feather edged. Where thoroughly dry, sandpaper to eliminate ridges and high points. Floating shall be at least 8" wide each side of joints and at trim. Sand all floated work smooth.
4. Floating at trim beads shall be flush with bead face and be gradually feathered back 8" to 10" from beads. Sand all floated work smooth.

G. Completed Work: Leave all surfaces clean, smooth and flat, ready to receive specified finishes.

3.05 ACOUSTICAL SYSTEMS

A. Place required sealant within and at top and bottom of all partitions scheduled to receive acoustical insulation. Installation in accordance with manufacturer's recommendations and/or U.L. requirements.

B. Place required sealant around all penetrations through or in partitions by conduit, pipe, ductwork, rough-in boxes, and similar items. The specific system will determine the necessary amount of forming material and permitted joint or annular space. Refer to U.L. Assembly requirements for additional/specific installation information.

3.06 CLEAN UP

A. Remove all excess material and rubbish accumulated from this work and leave area clean.

END OF SECTION
SECTION 09 51 00 - ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1 - General Requirements, govern work under this Section whether attached hereto or not.

B. Read all other Sections of the Specifications, which together with the Drawings and this Section, describe the Acoustical Ceiling work.

C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRADES

A. Cooperate and coordinate with other trades involved in this project where work of such trades affects, or is affected by, the Acoustical Ceiling work. Coordinate with mechanical and electrical trades to avoid conflict of ceiling hangers, runners, cross tees and bracing with installation of mechanical and electrical work.

B. Verify location of light fixtures and space conditioning outlets in ceiling pattern; final location of these items in ceiling pattern; final location of these items in ceiling pattern is responsibility of Acoustical Ceiling Contractor. Refer to reflected ceiling plans.

C. Cut ceiling boards to fit at pipes, conduit hangers, and other items projecting through ceiling or bordering acoustical ceiling area.

1.03 SCOPE OF WORK

A. Work under this Section of the Specifications consists of the furnishing of all labor, materials, equipment, incidentals and the performance of all operations necessary to complete all Acoustical Ceiling work as indicated or reasonably inferred from the Drawings and Specifications.

B. Work Included:
   1. Acoustic boards.
   2. Suspension systems.

1.04 RELATED WORK

A. Section 09 22 00 - Suspended Gypsum Board Furr downs/Ceilings
B. Division 21 – Fire suppression devices within suspension system.

C. Division 23 - Air diffusers within suspension system.

D. Division 26 - Lighting Fixtures and devices within suspension system

1.05 QUALITY ASSURANCE

A. As a minimum and as applicable, comply with local code requirements and the following:
   1. ASTM C-635 - Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
   2. ASTM C-636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
   3. Underwriters Laboratories, Inc. (U.L.)

B. Uniformity: To maximum extent possible, provided all work of this Section as produced by one manufacturer.

C. Acceptable manufacturers:
   1. Armstrong.
   2. Donn Products.
   3. Celotex.
   4. USG Interiors.

1.06 SUBMITTALS

A. Make submittals in accordance with Section 01 33 00.

B. Prior to placing acoustical order, submit:
   1. Manufacturer's product data, and technical information and installation instructions for materials required.
   2. Provide two 12” x 12” samples of each type of acoustical unit. Provide two samples of suspension system and accessories.

1.07 PRODUCT HANDLING

A. Carefully cover and protect acoustical ceiling materials when in transit and at the job site.

B. Store in dry locations in original containers with seals unbroken and labels intact until time of use, in accordance with manufacturer's instructions.
1.08 JOB CONDITIONS

A. Do not install acoustical ceilings until sufficient heat is provided, dust-generating activities have terminated, and overhead mechanical work is completed, tested and approved.

B. Maintain temperature at minimum 60 degrees F. and humidity of 40% to 50% prior to, during and after installation.

PART 2 - PRODUCTS

2.01 ACOUSTICAL BOARDS

A. Lay-In Ceiling Board.
   1. General: Lay-in ceiling materials shall be rated 0-25 flame spread in accordance with ASTM E-84 and Class A in accordance with FS SS-S-118B.
   2. Standard Mineral Board – Ceiling Type 1
      a. Material: 24" x 24" x 5/8" mineral board panel.
      b. Type: Square edge (SQ).
      c. Noise Reduction Coefficient: NRC .50-60
      d. Light Reflectance: .85
      e. Finish: Factory applied washable white latex.
      f. Design: USG “Radar ClimaPlus” or equivalent by listed manufacturer.
      g. Grid Type: "A".
   3. Tegular Mineral Board - Ceiling Type 2.
      a. Material: 24" x 24" x 5/8" mineral board panel.
      b. Type: Tegular (SLT).
      c. Noise Reduction Coefficient: NRC .50-60
      d. Light Reflectance: .85
      e. Finish: Factory applied washable white latex.
      f. Design: USG “Radar” or equivalent by listed manufacturer.
      g. Grid Type: "A".

2.02 SUSPENSION SYSTEMS

A. Grid Type "A".
   1. Standard grid system (including hold-down clips as required) formed from commercial quality cold rolled steel, electro-zinc coated and pre-painted cap.
   2. Size: 15/16” exposed tee system, “DX/DXL” or equivalent.
   3. Comply with ASTM C-635.
   4. Finish: Low sheen satin white.
PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Install acoustical ceiling systems in accordance with acoustical unit manufacturer's recommendations and ASTM C-636 to produce finished ceilings true to lines and levels and free from warped, soiled or damaged grid or lay-in panels. Erect in accordance with reflected ceiling plans.

B. Install ceiling system in a manner capable of supporting all superimposed loads, with maximum permissible deflection of 1/360 of span and maximum surface deviation of 1/8" in 10', non-cumulative.
   1. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest adjacent hangers and related carrying members as required to span the required distance.

C. Hang ceilings independently of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of the longitudinal axis or face plane of adjacent members. Provide hanger wire within 6" of two diagonal corners of each light fixture and diffuser installed.

D. Center ceiling systems on room axis leaving equal border pieces. No pieces less than one half of a full tile shall be installed in the suspended ceiling system unless shown otherwise.

E. Do not support fixtures from or on main runners or cross runners if weight of the fixtures causes the total dead load to exceed the deflection capability. In such cases, support fixture loads by supplementary hangers located within 6 inches of each corner or support the fixtures independently.
   1. Do not install fixtures so that main runners and cross runners will be eccentricity loaded.
   2. Where fixture installation would produce rotation of runners, provide stabilizer bars.

F. Install angle moldings at intersection of ceiling and vertical surfaces, using maximum lengths, straight, moldings at junctions with other ceiling finishes, light fixtures, ceiling diffusers and grilles as required. Where bullnose concrete block corners occur, provide preformed closers to match edge molding as approved. Use factory exterior corners for all exterior corners on edge molding.

G. Fit acoustic lay-in panels in place, free from damaged edges and other defects detrimental to appearance and function. Fit cut units neatly against abutting surfaces.

H. Fit units snugly around pipes, hangers, conduit and all other penetrations through suspended ceilings. Provide metal trim or escutcheon, matching grid color, at penetrations in exposed locations.

I. Ceiling Heights: Finish ceiling heights are indicated on Drawings.
3.02 ADJUSTMENTS

A. Adjust sags and twists that may develop in ceiling systems and replace units and parts which are damaged or faulty as directed by Architect.

3.03 CLEANING

A. At completion, if any units are dirty, discolored, or damaged as a result of work performed under this Contract or defective or improperly placed, remove such units and replace as directed by the Architect.

B. At completion of the work, deliver one (1) carton, at least 48 pieces of acoustical ceiling tile to Owner for future replacement use.

END OF SECTION
SECTION 09 65 00 - RESILIENT FLOORING

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1 - General Requirements, govern work under this Section whether attached hereto or not.

B. Read all other Sections of the Specifications, which together with the Drawings and this Section describe the Resilient Flooring Work. Verify all dimensions and conditions at the site.

C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRADES

A. Cooperate and coordinate with other trades involved in this project where work of such trades affects or is affected by Resilient Flooring work.

B. Before beginning work, inspect surfaces to receive resilient materials and notify Architect, in writing, of any conditions, which will prevent proper installation, adherence, appearance, or permanency of flooring. Do not begin work until such conditions have been corrected or an agreement reached regarding later defects, which may develop due to such conditions.

C. Absence of such notification or beginning of work denotes acceptance of surface and later claims of defects in surfaces will not in any way relieve Contractor from responsibility under the guarantee.

1.03 SCOPE OF WORK

A. Work under this Section of the Specifications consists of furnishing all labor, materials, equipment, incidentals, and the performance of all operations necessary to complete all Resilient Floor and base work indicated or reasonably inferred from the Drawings and Specifications.

B. Work Included:
   1. Vinyl composition tile.
   2. Luxury Vinyl Tile.
   3. Rubber base.
   4. Flooring accessories.
   5. Cleaning or stripping existing concrete slab.
1.04 RELATED WORK

A. Section 09 68 00 - Carpet

1.05 QUALITY ASSURANCE

A. As a minimum and as applicable, comply with the following:

B. Uniformity: To the maximum extent possible, provide resilient products from one manufacturer only.

C. Acceptable Manufacturers:
   1. Vinyl Composition Tile
      a. Armstrong World Industries, Inc.
      b. AZ rock Floor Products.
      c. Tarkett, Inc.
   2. Luxury Vinyl Tile
      a. Karndean.
      b. Armstrong World Industries, Inc.
      c. Tarkett, Inc.
   3. Resilient Base
      a. Armstrong World Industries, Inc.
      b. Johnsonite.
      c. Roppe Rubber Corporation.
   4. Flooring Accessories (Nosing, Transitions, etc.).
      a. Johnsonite.
      b. Roppe Rubber Corporation.
      c. R.C. Musson.

1.06 SUBMITTALS

A. Make submittals in accordance with Section 01 33 00.

B. Prior to placing material order, submit:
   1. Product manufacturer's technical data and installation instructions for each type of resilient material and accessory proposed for use.
   2. Provide two 12"x12" samples of color, pattern and finish for each type of resilient material indicating full range of color and pattern.

C. Prior to final acceptance submit 2 copies of manufacturer's recommended maintenance procedures for each type of resilient flooring provided.
1.07 JOB CONDITIONS

A. Maintain minimum temperature of 70 degrees F in spaces to receive resilient flooring for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. Subsequently, maintain minimum temperature of 55 degrees F in area where work is completed.

B. Install resilient flooring and accessories after other finishing operations, including painting, have been completed. Moisture content of concrete slabs and environmental conditions must be within limits recommended by manufacturer of products being installed.

PART 2 - PRODUCTS

2.01 VINYL COMPOSITION TILE (VCT)

A. Comply with Federal Specification SS-T-312B, Type IV Comp. 1, asbestos-free.

B. Size: Minimum 1/8" thick x 12" x 12".

C. Premium Material: Armstrong Standard Excelon or equivalent by one of the listed manufacturers. Colors and patterns as selected by Architect from manufacturer's standard line of colors.

D. Edging Strips: 1/8" thick standard vinyl type in color to be selected by the Architect.

2.02 LUXURY VINYL TILE (LVT)

A. Size: Minimum 1/8” thick x 6” x 48”.

B. Premium Material: wood/stone contour Series, 30 mil wear layer or equivalent by one of the listed manufacturers. Colors and patterns as selected by Architect from manufacturer’s standard line of colors.

C. Edging Strips: MetalEdge Un #ME001, in color to be selected by the Architect.

2.03 RUBBER COVE BASE

A. 1/8" thick x 4" high x 4 ft. pieces or 120 ft. coil, of standard coved 100% SBR rubber base.

B. Colors to be selected by the Architect from manufacturer's standard line of colors.
2.04 ACCESSORIES

A. Provide 100% SBR rubber accessories as required for a complete installation. Architect to select colors from manufacturers full color range. Products listed below as manufactured by Roppe Rubber Corp. Other manufacturers are listed above.
1. Reducer Strip - resilient flooring strip, 1" wide x 1/8", 1/16", or 3/32" thickness as required tapered or bullnose.
2. Carpet Edge - No. 38, carpet to concrete slab.
3. Carpet/Tile - No. 50, carpet to resilient tile joiner.

2.05 FILLERS, PRIMERS AND ADHESIVES

A. Joint, crack, and depression filler: Cement patching compound equal to HENRY 545, Feather Edge Cement Patch. For additional bond integrity, combine with HENRY 546 Feather Edge Additive.

B. Concrete Slab Primer: Non-staining type as recommended by resilient material manufacturer for substrate conditions encountered.

C. Adhesives (Cements): Waterproof, stabilized type as recommended by resilient material manufacturer for substrate conditions encountered.

PART 3 - EXECUTION

3.01 SITE AND SUBSTRATE CONDITIONS

A. Ensure floor surfaces are smooth and flat with maximum variation of 1/8" in 10 feet.

B. Moisture Testing: Installer to conduct and moisture test (1 per 1000 SF of floor area) to determine the moisture content of the concrete floor system PRIOR to installing floor products. Ensure concrete floors are dry (maximum moisture content 5 lbs/100 SF/ 24 hours) and exhibit negative alkalinity, carbonization and/or dusting. Existing concrete slab must be prepared to provide a satisfactory bonding surface for all adhesives used.

C. Maintain minimum air temperature at flooring installation as specified in Article 1.07 above.

D. Store flooring materials in area of application. Allow 3 days for material to reach equal temperature as area before installing.

3.02 LEVELING

A. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other slab defects with an approved leveling compound.
B. Trowel and float filler to leave smooth, flat hard surfaces as recommended by flooring manufacturer. Prohibit traffic until leveling compound filler is cured.

3.03 INSTALLATION, TILE FLOORING (Includes LVT)

A. Open floor tile cartons, enough to cover each area, and mix tile to ensure shade variations do not occur within any one area.

B. Clean substrate. Spread cement evenly in quantity recommended by flooring manufacturer to ensure adhesion over entire area of installation. Spread only enough adhesive to permit installation of flooring before initial set.

C. Set flooring in place, roll and press with heavy roller to ensure full adhesion.

D. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.

E. Install with minimum tile width 1/2 full size at room or area perimeter with pattern grain parallel for all units and parallel to length of room.

F. Terminate resilient flooring at centerline of door at openings where adjacent floor finish is dissimilar.

G. Install edge strips at unprotected or exposed edges where flooring terminates.

H. Scribe flooring to walls, columns, cabinets, floor outlets and other appurtenances to produce tight joints.

I. Continue flooring through areas to receive moveable type partitions without interrupting floor pattern.

J. Floor finish (Wax) for VCT to be completed by TAMU.

3.04 INSTALLATION, BASE

A. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.

B. Miter internal corners. Use premolded sections for external corners and exposed ends.

C. Install base on solid backing. Adhere tightly to wall and floor surfaces. Do not install over vinyl wallcoverings or epoxy paint.

D. Scribe and fit to doorframes and other obstructions.

E. Install straight and level to variation of plus or minus 1/8 inch over 10 feet.
3.05 INSTALLATION, ACCESSORIES

A. Install specified accessories at all locations where flooring terminates at higher level than adjacent floor surfaces and at door openings to rooms having exposed concrete floors.

3.06 PROTECTION

A. Protect flooring from damage due to subsequent construction operations with building paper, mats, or other approved means, maintain protective covering until completion of work.

B. Repair any damage to floor or base installations resulting from operations under this project contract at no expense to Owner.

3.07 CLEAN-UP

A. Remove excess adhesive from floor, base and wall surfaces.

B. Just prior to final inspection, thoroughly clean floor and base surfaces in accordance with manufacturer's printed recommendations. Follow with a thorough rinsing of clean water and leave floor in condition for Owner to apply wax and buff.

C. Replacement materials
   1. After completion of work, deliver to project site replacement materials from same manufactured lot as materials installed, as follows:
      a. Tile flooring, not less than one box for each 50 boxes or fraction thereof, for each type, size, and color installed.
      b. Rubber base, not less than 5% of lineal feet total installed.
   2. Clearly identify each box and roll.
   3. Replacement materials shall not be used for Contractor's warranty work.

END OF SECTION
SECTION 09 68 00 - CARPETING

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

   A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1 - General Requirements, govern work under this Section whether attached hereto or not.

   B. Read all other Sections of the Specifications, which together with the Drawings and this Section describe the Work of this Section.

   C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRADES

   A. Cooperation by Contractor for work of this Section with all other trades is mandatory so that all phases of the work may be properly coordinated without delays or damage to any parts of the work.

1.03 SCOPE OF WORK

   A. Work under this Section of the Specifications consists of the furnishing of all labor, materials, equipment, incidentals and the performance of all operations necessary to complete the installation of all Carpet work in areas as indicated on the Drawings. Verify all dimensions and conditions at the site.

   B. Work Included:
      1. Installation of all carpet floor covering including decorative borders.
      2. All moldings, fasteners, adhesives, tapes, and incidentals as necessary to complete carpet work.
      3. Preparation of surfaces to receive carpet.
      4. Manufacturer's acceptance of installer.

1.04 RELATED WORK

   A. Section 09 65 00 - Resilient flooring and base.

1.05 QUALITY ASSURANCE

   A. Provide written certification from carpet manufacturer establishing acceptability of applicator, and that applicator is knowledgeable and experienced in installation of carpet of the specified type.
B. Applicator shall be a firm with at least 5 years experience with a listing of 5 successful installations similar to work required for this project.

C. Work of this Section shall comply with applicable requirements of the Texas Architectural Barriers Act, as identified in the Texas Government Code, Chapter 469, Elimination of Architectural Barriers and with the Americans with Disabilities Act (ADA).

1.06 SUBMITTALS

A. Make submittals in accordance with Section 01 33 00.

B. Prior to placing carpeting order, submit:
   1. Full range of carpet color samples for Architect's selection.
   2. Carpet manufacturer's literature showing complete specification for carpet, including description of yarn, backings, recommended adhesives and laying methods.
   3. Fiber manufacturer's letter certifying fiber content.
   4. Shop drawings showing location of all seams, method of joining seams, direction of carpet, type of adhesive to be used and installation procedures.

1.07 DELIVERY AND STORAGE

A. Deliver carpeting material in protective wrapping, store inside building protected from weather, moisture and soiling.

1.08 JOB CONDITIONS

A. Do not start carpet installation until painting and finishing work is complete and ceilings and overhead work, have been tested, approved, and completed.

B. Maintain room temperature at minimum 60 degrees F. for at least 24 hours prior to installation and relative humidity at approximately that at which the area is to be permanently maintained.

C. Provide sufficient lighting for proper installation and review of work.

PART 2 - PRODUCTS

2.01 CARPET TYPES - BROADLOOM

A. Carpet Types: All Carpet shall be direct glue-down type and shall be provided in the spaces scheduled on the Drawings.
   1. Manufacturer – Tarkett Garden Walk Collection “Radiance K0101”
      a. Weave -tufted
      b. Tufted patterned Symtex.
      c. Gauge – 12.3”
d. Stitch count – 5/64”
e. Pile height – 0.197 inch.
f. Face yarn - Nylon.
g. Dye system – Solution Dyed.
h. Face yarn weight - 26 oz/sq. yd.
i. Cushion backing, Ego-Bloc.
j. Color and pattern - Architect to select color and pattern to match existing.

2. Manufacturer – Tarkett Garden Walk Collection “Terrace 40050”
   a. Weave - tufted.
b. Surface texture – patterned Loop.
c. Gauge – 5/64”
e. Pile height - 0.217 inch.
f. Face yarn – Nylon.
g. Dye system – Solution dyed.
h. Face yarn weight - 32 oz/sq. yd.
i. Cushion backing, Ego-Bloc.
j. Color and pattern - Architect selected color and pattern.

B. Decorative borders or in-lays will account for 20% of the total yardage. Border and in-lay carpet shall be selected from the same manufacturer as the field carpet.

2.02 CARPET ACCESSORIES

A. Adhesive: Water - resistant type as recommended in writing by carpet manufacturer, and which complies with flammability requirements for installed carpet, including seam sealer.

B. Joint, crack, and depression filler: Cement patching compound equal to HENRY 545, Feather Edge Cement Patch. For additional bond integrity, combine with HENRY 546 Feather Edge Additive.

PART 3 - EXECUTION

3.01 PREPARATION OF SURFACES

A. Clean floors free of dust, dirt, solvents, oil, grease, paint, plaster and other substances detrimental to proper performance of adhesive and carpet.

B. Ensure floors are level, with maximum surface variation of 1/4 inch in 10 feet, noncumulative.

C. Ensure concrete floors are free from scaling and irregularities and exhibit neutrality relative to acidity and alkalinity. Rough spots shall be smoothed where necessary and all joints, cracks, and small holes filled with approved cementitious filler.

D. Vacuum, sand and clean substrate.
3.02 INSTALLATION

A. All carpet and materials shall be installed by skilled workmen under proper supervision using the manufacturer's approved methods, tools and equipment. All cutting, sewing, seaming and accessories required to properly install carpet shall be in accordance with manufacturer's recommendations.

B. The carpet Subcontractor shall be fully responsible for the installation and condition of all carpet until it has been accepted. It shall be stored in a well-ventilated space and protected from damage, dirt, stains, moisture, and vandalism.

C. The carpet Subcontractor shall inspect the subflooring before starting his work. He shall notify the Architect in writing, of any condition, which will prevent him from satisfactorily completing his work. He shall not proceed with his work until all defects are entirely corrected. The application or installation of carpet by the carpet sub-contractor shall constitute his acceptance of the subfloor.

D. Check matching of carpet before cutting and ensure there is no visible variation between dye lots.

E. Cut carpet, as required, in manner to allow proper seam and pattern match. Ensure cuts are straight and true and unfrayed. Locate seams in areas of least amount of traffic in accordance with approved shop drawings. Do not seam carpet in doorway paths. Join seams in recommended manner so as not to detract from appearance of carpet installation and decrease its life expectancy. Ensure seams are straight, not overlapped or peaked and free of gaps.

F. Spread adhesive in quantity recommended by manufacturer after primer application to ensure proper adhesion over full area of installation. Apply only enough adhesive to permit proper adhesion of carpet before initial set.

G. Lay carpet with the run of the pile in same direction of anticipated traffic. Lay carpet on stairs with run of the pile in opposite direction of anticipated traffic to avoid peeking of backing at nosing. Do not change run of pile in any one room or from one room to next where continuous through a wall opening.

H. Apply a 1/8” bead of Seam Sealer to the first carpet edge.

I. Cut and fit carpet neatly around projections through floor and to walls and other vertical surfaces. Fit carpet snugly to borders, inlays, walls and all other vertical surfaces leaving no gaps.

J. Do not place heavy objects such as furniture on carpeted surfaces for minimum of 24 hours or until adhesive is set. Entire carpet installation shall be laid tight and flat to subfloor, well fastened at edges and present a uniform pleasing appearance. Ensure monolithic color, pattern and texture match within any one area.
K. Install edging strips where carpet terminates at other floor coverings. Use full-length pieces only. Butt tight to vertical surfaces. Where splicing cannot be avoided, butt ends tight and flush.

3.03 CLEAN UP

A. After completion of installation, the Carpet Contractor shall clean up all scraps and debris and shall clean all carpet in strict accordance with manufacturer's written instructions as approved by the Architect. The Architect shall inspect all carpet scraps before removal from job and retain any or all pieces for use in the future for patching or repairing.

B. Prior to final acceptance, furnish:
   1. Three (3) percent overrun of carpet yardage installed for Owner's replacement use. This carpet shall be delivered in full rolls packaged for storage. Store in building in location as directed by Architect.
   2. Printed instructions for proper carpet maintenance and recommended cleaning methods and materials.

3.04 WARRANTY

A. The Carpet Contractor shall furnish the Owner a written warranty providing for the relaying or re-stretching of any carpet that does not provide an attractive, wrinkle-free appearance, and shall correct any such condition due to faulty installation which may appear for a period of one year from the date of acceptance by the Owner.

B. Provide manufacturers 10-year warranty to replace all carpet that exhibits excessive wear of pile.

END OF SECTION
SECTION 09 91 00 - PAINTING

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1 - General Requirements, govern work under this Section whether attached hereto or not.

B. Read all other Sections of the Specifications, which together with the Drawings and this Section describe the Painting and Finishing work. Verify all dimensions and conditions at the site.

C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRADES

A. Cooperate and coordinate with other trades involved in this project where work of such trades affects or is affected by Painting and Finishing work.

B. Examination of surfaces:
   1. Before beginning work, inspect surfaces to be painted or finished and notify the General Contractor, and Architect, in writing, of any conditions which will prevent satisfactory execution, appearance and permanency of work.
   2. Verify compatibility of existing finishes with proposed coatings scheduled for repainting.
   3. Priming and sealing of pipe insulation are provided under mechanical sections of the Specifications. Inspect and accept surface as suitable to receive specified finish without excessive suction which will prevent full covering and concealment of insulation casing, or notify the General Contractor, and Architect that priming and sealing or insulation is defective or insufficient.
   4. Do not begin work until any such conditions have been corrected or an agreement reached regarding later defects, which may develop due to such conditions.
   5. Absence of any such notification or beginning of work denotes acceptance of surface and later claims of defects in surfaces will not in any way relieve Contractor from responsibility under this guarantee.

1.03 SCOPE OF WORK

A. Work under this Section of the Specifications consists of the furnishing of all labor, materials, equipment, incidentals and the performance of all operations necessary to complete all Painting and Finishing of interior and exterior work as indicated or reasonably inferred from the Drawings and Specifications.
B. Painting and finishing work includes, but is not limited to, all items as hereinafter listed and specified. Perform work required to prepare surfaces to receive paint, finish, or applied covering. Read all other Sections of the Specifications and properly determine the extent of the work to be performed under this Section.

C. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

D. Color Schedules
   1. The Architect will prepare a color schedule with samples for guidance in painting and finishing surfaces throughout the project.
   2. The Architect may select, allocate, and vary colors on different surfaces throughout the project and should be based on the following:
      a. Interior Work: A maximum of four different colors will be used, with miscellaneous work, and metal work.
      b. Dark Tones: A maximum of two additional dark tones will be used as accent colors for interior work.

E. The term "exposed" as used herein and on the drawings shall be interpreted to mean, "exposed to view in the work at any area" at the time of final inspection as determined by the Architect. This shall include mechanical rooms, closets, storage room and like areas unless specifically indicated to be left unpainted.

F. Where items or surfaces are not specifically mentioned, paint same as adjacent similar materials or areas. If color or finish is not indicated, Architect will select these from standard colors available from materials systems specified.

G. Work Included:
   1. Structural Steel and Miscellaneous Metals:
      a. Touch up shop coats on all exposed and concealed metals at locations of welds, abrasions, scratches, and elsewhere that paint film or coating is defective. will be painted to provide “black out” space above the 12’-0” ceiling height in all exposed, open areas.
      b. Paint all metals exposed to view on interior and exterior of building.
   2. Paint all exposed metals, galvanized or not will be painted to provide “black out” space above the 12’-0” ceiling height in all exposed, open areas.
   3. Items of mechanical, plumbing and electrical work in exposed locations, interior, will be painted to provide “black out” space above the 12’-0” ceiling height in all exposed, open areas.
      a. Paint exposed shop coated, galvanized and ungalvanized ferrous metals, and non-ferrous metals.
      b. Paint exposed insulation.
   4. Piping and Conduit - Paint exposed insulated and uninsulated piping and conduit will be painted to provide “black out” space above the 12’-0” ceiling height in all exposed, open areas.
   5. Gypsum board: tape and float all gypsum board; texture and paint gypsum board as indicated on Room Finish Schedule. Refer to drawings for “black-out” requirements.
6. Paint all interior ferrous metals (structure, fireproofing, fur down framing, ductwork, conduit, piping) will be painted to provide “black-out” space above the 12’-0” ceiling height in all exposed, open areas.
7. Finish all wood trim.
8. Metal frames: Paint all ferrous metal door frames, including access doors.
9. Fire proofing: new and existing will be sealed and painted to provide “black out” space above the 12’-0” ceiling height in all exposed, open areas.
10. Seal existing concrete flooring to remain exposed.

1.04 RELATED WORK

A. Certain coats are provided under other Sections. Before applying additional coats, examine primed surface carefully and remove any evidence of rust or scaling, touch up all scars and abrasions.

B. Except for touch-up of shop coats, painting typically will not be required in concealed spaces above interior ceilings.

1.05 QUALITY ASSURANCE

A. Mock-up
   1. Before starting project painting, finish approximately 100 sq. ft. of wall surface and “black-out” areas for each color scheme required, clearly indicating selected colors, finish texture, materials and workmanship. Lighting conditions shall approximate those of permanent lighting system.
   2. If approved, sample areas will serve as a quality comparison standard for work of this Section.

B. Manufacturers
   1. Use specified materials of Sherwin-Williams or similar first line material of one of the following manufacturers and as approved by the Architect.
      a. Benjamin Moore
      b. Pratt & Lambert
      c. Glidden Coatings and Resins
      d. Pittsburgh Plate Glass Co.
   2. Colors - Manufacturer's standard colors that closely match colors selected by Architect from Sherwin-Williams color system will be acceptable; subject however to Architect's approval of color match proposed.

1.06 SUBMITTALS

A. Make submittals in accordance with Section 01 33 00.

B. Five weeks prior to start of painting work, submit:
   1. Complete schedule of painting materials proposed for use on this project in form similar to form of Article 2.03 hereinafter. Include sufficient technical data to enable Architect to properly evaluate paint products being proposed for use.
Painting – 09 91 00.4
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2. Color samples: Submit color samples for Architect's review as follows:
   a. On 12" x 12" gypsum board, provide two samples of each color and material, with texture to simulate actual conditions. Resubmit samples as requested by Architect until acceptable sheen, color, and texture is achieved.
   b. On actual wood surfaces, provide two 12" x 12" samples of natural and stained wood finish. Label and identify each as to locations and application.

1.07 DELIVERY AND STORAGE

A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:
   1. Name or title of material.
   2. Fed. Spec. Number, if applicable.
   3. Manufacturer's stock number and date of manufacture.
   4. Manufacturer's name.
   5. Contents by volume, for major pigment and vehicle constituents.
   6. Thinning instructions.
   7. Application instructions.
   8. Color name and number.

B. Painting materials and equipment shall be stored in one approved place in building. Damage done at this location shall be corrected, and special care shall be taken to prevent fire due to spontaneous ignition of oily rags or mishandling of inflammable materials.

1.08 JOB CONDITIONS

A. Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F and 90 degrees F.

B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F and 95 degrees F.

C. Do not apply paint in snow, rain, fog or mist. Do not apply paint when relative humidity exceeds 85%. Do not apply paint to damp or wet surfaces.

D. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed conditioned within temperature limits specified by paint manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.01 COLORS AND FINISHES

A. Prior to start of painting work, Architect will furnish color chips for various surfaces to be painted. Responsibility for obtaining proper colors for all items requiring painting shall rest solely with the Contractor.
B. Final acceptance of colors will be from samples applied on the job.

2.02 MATERIALS, GENERAL

A. Brand name or paint products of a particular manufacturer mentioned in these specifications, is not intended to limit Contractor to use of that material exclusively unless so stated, but to serve as a standard of comparison. It is understood that the Architect shall approve materials proposed for use in any instance.

B. In instances where no brand or trade name is mentioned, material used shall be the best grade of that particular kind for the particular use, as recommended by the paint manufacturer and as approved by Architect.

C. Provide best quality grade (top or first line) of various types of paint coatings as regularly manufactured by acceptable paint materials manufacturers approved by the Architect. Materials not displaying manufacturer's identification as a standard, best-grade (top line) product will not be acceptable.

D. Provide undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by the paint manufacturer and use only within recommended limits.

E. Basic painting materials such as Linseed Oil, Shellac, Turpentine, Thinners, Driers, Putty, Tinting, Color, etc., of highest quality with identifying labels on containers.

F. Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information on characteristics of finish materials proposed for use, to ensure compatible primers or remove and re-prime as required. Prior to start of work of this Section, notify Architect in writing of any anticipated problems using specified coating systems with substrates primed by others.

2.03 PAINTING AND FINISHING QUALITY STANDARDS

A. General: Apply the following paint systems to the various substrates as specified hereinafter.

B. All exposed materials (fireproofing, fire sprinkler piping, plumbing, VAV boxes, ductwork, structural steel, miscellaneous steel, conduit and all other exposed materials) that are visible in the open ceiling areas in the Meeting Room spaces will be painted to provide a “black out” finish.
   2. Apply one or two coats flat Pro Industrial Waterborne Acrylic Dryfall paint to cover existing substrate.
C. Exposed Steel (not galvanized, where primed or unprimed):
   1. Touch-up shop coat and field welds: Pro-Cryl Universal Water Based Primer (B66W310).
   2. Interior surfaces, two coats Pro Industrial Zero VOC Acrylic Semi-Gloss (B66W651).

D. Metal Frames:
   1. Apply one coat Pro Industrial Pro-Cryl Universal Metal Primer (B66W310).
   2. Interior surfaces, apply two coats Pro Industrial Zero VOC Acrylic Semi-Gloss (B66W651).

E. Interior structural framing and metal fabrications (whether primed or unprimed):
   1. Concealed in (built-in) the finished work.
      a. Touch up abrasions, welds and bolts – Pro Industrial Pro-Cryl Universal Metal Primer (B66W310).
   2. Items exposed on interior, except as otherwise noted or specified.
      a. Touch up abrasions, welds and bolts – Pro Industrial Pro-Cryl Universal Metal Primer (B66W310).
      b. Cover marking crayon identification symbols with shellac.
      c. Apply one coat Pro Industrial Pro-Cryl Universal Metal Primer (B66W310).
      d. Apply two coats Sherwin-Williams Pro Industrial Urethane Alkyd Enamel (B54W151).

F. Gypsum Wallboard
   1. For areas scheduled as painted gypsum board:
      a. Apply texture material to finished wallboard by rolling on a sufficient quantity to obtain a "light and stipple" texture for walls (and acoustic texture for ceiling) in the finished work.
      b. Apply one coat High Build Interior Latex Primer/Surfacer (B28W8601).
      c. Apply two coats Pro Mar 200 Zero VOC Latex Eg-Shel Enamel (B20W2600).
   2. For repainting existing gypsum wallboard:
      a. Apply two coats Pro Mar 200 Zero VOC Latex Eg-Shel Enamel (B20W2600).

G. Wood Trim scheduled to receive "Natural" finish:
   1. Apply one coat MinWax Interior Stain.
   2. Apply two coats MinWax Polyurethane Varnish.

H. All wood scheduled to receive painted finish:
   1. Apply one coat Premium Wall & Wood Primer.

I. Sealed exposed concrete floors:
   1. Apply one coat of Super Rez-Seal VOX by the Euclid Chemical Company.
PART 3 - EXECUTION

3.01 INSPECTION

A. Applicator shall examine areas and conditions under which painting work is to be applied and notify Architect and Contractor in writing of conditions detrimental to proper and timely completion of work.

B. Starting of painting work will be construed as acceptance of surfaces and conditions within any particular area.

C. Do not paint over dirt, rust, scale, grease, oil, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

3.02 REFINISHING OF EXISTING SURFACES

A. Where an existing room is noted on the drawings to be painted it is the intention of these specifications that the Contractor prior to starting the painting work to determine the soundness of the existing surface and check all surfaces of the type noted to be painted within the room.

B. All cracks and voids shall be scraped and removed. Existing painted surfaces shall be sanded and conditioned as required to ensure that new paint coating will adhere properly to the existing surfaces. Joints around windows and doors and any surfaces shall be properly primed for finish paint coating. Where a portion of a wall is painted, the whole wall shall be repainted.

C. Where existing acoustic tile suspension system is noted to be painted, all damaged grid shall be replaced with new grid prior to painting.

D. Verify existing paint material prior to painting to determine compatibility with proposed finishes. Test for proper adhesion.

E. Existing transparent or “Natural” finishes shall be removed prior to repair work and new finish applied.

F. Remove all existing extraneous items (nails, screws, adhesives, bolts) from existing surfaces to remain. Patch, repair, fill all cracks, holes, checks and other surface damage as required prior to applying finish coats. Texture to match surrounding (similar) materials.

3.03 SURFACE PREPARATION

A. General:
   1. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.
2. Remove door hardware, hardware accessories, cover plates, lighting fixtures, and similar items in place and not to be finish-painted or provide surface-applied protection prior to surface preparation and painting operations. Following completion of painting of each space or area, reinstall removed items.

3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.

B. Cementitious Materials
   1. Prepare cementitious surfaces of concrete to be sealed by removing efflorescence, chalk, dust, dirt, grease, oils, and by surface cleaning as required to remove any glaze. Remove ridge on bullnose concrete masonry units before applying block filler.
   2. Clean concrete floor surfaces scheduled to be sealed with a commercial solution of cleaner, flush floor with clean water to neutralize cleaner, and allow to dry before sealing.

C. Wood:
   1. Clean wood surfaces to be painted of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.
   2. Prime, stain, or seal wood required to be job-painted at the earliest possible moment. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, paneling.
   3. When transparent finish is required, use spar varnish for backpriming.
   4. Back prime paneling on interior partitions only where masonry, plaster or other wet wall construction occurs on backside.
   5. Seal top, bottom, opening, and hardware recesses of unprimed wood doors with two coats of varnish or equivalent sealer immediately after fitting, before hanging. Edge seals are particularly important.

D. Ferrous Metals:
   1. Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.
   2. Touch-up shop-applied prime coats wherever damaged or bare, where required by other sections of these specifications. Clean and touch-up with same type shop primer.
3.04 APPLICATION

A. General:
1. Apply paint/sealer in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied. All woodwork, gypsum board and concrete floor surfaces scheduled to be painted/sealed will be painted with a brush and/or roller only.
2. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
3. Painting or lacquering must be done under conditions, weather or temperature, suitable for executing a first-class job. Atmosphere must be free from dust and dirt preventing lodgement of foreign matter in fresh paint or lacquer. Floors must be broom clean before painting is started.
4. Woodwork to be stained must be in perfect condition, dry and free from surface blemishes, stains, soil or other defects.
5. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only before final installation of equipment.
6. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
7. Sand lightly between each succeeding enamel or varnish coat.
8. Slightly vary the color of succeeding coats.
   a. Do not apply additional coats of paint until completed coat has been inspected and approved.
   b. Only the inspected and approved coats of paint will be considered in determining the number of coats applied.
9. Omit first coat (primer) on metal surfaces, which have been shop-primed, and touch-up painted, unless otherwise indicated.

B. Scheduling Painting:
1. Apply first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
2. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.

D. Prime Coats:
1. Apply prime coat of material, which is required to be painted or finished, and which has not been prime coated by others.
2. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

E. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surfaces imperfections.

F. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.

G. Transparent (Clear) Finishes:
   1. Use multiple coats to produce glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.
   2. Provide satin finish for final coats, unless otherwise indicated.

H. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with project requirements.

3.05 CLEAN-UP AND PROTECTION

A. Clean-up:
   1. During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each workday.
   2. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

B. Protection:
   1. Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
   2. Provide "Wet Paint" signs as required to protect newly-painted finished. Remove temporary protective wrappings and coverings after completion of painting operations.
   3. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

C. Maintenance Materials: Prior to final acceptance, provide one gallon of each color and type of finish coat material for Owner's use as touch-up after final acceptance of the work.

END OF SECTION
SECTION 10 22 26 - FOLDING PARTITIONS

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1 - General Requirements, govern work under this Section whether attached hereto or not.

B. Read all other Sections of the Specifications, which together with the Drawings and this Section describe the Folding Partitions work. Verify all dimensions and conditions at the site.

C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRADES

A. Folding Partitions furnished under this Section will be installed by other trades unless specifically stated otherwise; furnish installation directions, setting drawings, templates, specifications, and other information required for clear understanding of setting and operation requirements.

1.03 SCOPE OF WORK

A. Work under this Section of the Specifications consists of the furnishing of all labor, materials, equipment, incidentals and the performance of all operations necessary to complete the Folding Partition work or reasonably inferred from the Drawings and Specifications.

B. Work Included:
   1. Folding Partitions.

1.04 RELATED WORK

A. Section 05 50 00 – Miscellaneous Steel.

B. Section 06 10 00 - Rough carpentry.

1.05 QUALITY ASSURANCE

A. As a minimum and as applicable, comply with the following:
B. Acceptable manufacturers:
   1. Modernfold.
   2. Panelfold, Inc.
   3. Hufcor, Inc.

1.06 SUBMITTALS

A. Submit in accord with Section 01 33 00.

B. Prior to start of fabrication, submit:
   1. Manufacturer's printed specifications and installation instructions.
   2. Shop drawings showing general layout, dimensions, base details, hardware
      anchorage, finishes and components of system.

C. Samples:
   1. Provide manufacturer's samples of color, pattern and texture for wall panels
      indicating full range of colors and patterns.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General - Panels
   1. Operable walls shall be Moduflex 400 Series, Model 410 as manufactured by
      Panelfold, Inc. or equivalent by one of the listed manufacturers.
   3. Operation: Manual, top supported, both pre-programed and multi-directional
      individual panel operable wall systems.
   4. Panel Construction: Class "A" flame spread rated panels with faces bonded under
      pressure to all bronze anodized aluminum frame.
   5. Panel Surfaces: factory laminated in manufacturers standard Woventex panel
      fabric; Class "A" Flame spread rated. Provide decorative plastic laminated
      surfaces as shown on the drawings.
   6. All operable public exit doors will have a Sargent Series 8700 panic devices with
      ETL trim (removable core) and photo luminescent exit signs at each exit.

B. Sound Seals
   1. Vertical seals between panels shall consist of continuous vinyl shapes installed in
      recessed grooves in the astragals and "soft seals" at intersections.
   2. Horizontal top and bottom seals shall be continuous vinyl shapes, tool-operated.

C. Suspension System
   1. Pre-programed wall system will utilize a Type 7/8 heavy duty aluminum track
      supported by adjustable steel 9” hanger rods. The Multi-Directional wall system
      will use a Type 9, heavy duty aluminum track with 9” hanger rods.
   2. Panels to be supported by radial type steel ball bearing wheels, attached with
      adjustable steel pendant bolts.
   3. Track will be adjusted during the initial installation for satisfactory operation.
      Chamber in the track maybe required for OP-1 for completed assembly.
PART 3 - EXECUTION

3.01 INSTALLATION

A. Opening prepared by General Contractor. Provide miscellaneous steel framing and joist reinforcing to suspend folding partition in locations shown on the structural drawings.

B. Installation by authorized representative, as per manufacturer's written instructions and Architect's drawings.

C. Comply with ASTM E-557.

D. The installer will provide additional on-site visits during the warrantee period to adjust/level Track at no additional cost to the Owner.

END OF SECTION
SECTION 10 26 00 – WALL PROTECTION

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1 - General Requirements, govern work under this Section whether attached hereto or not.

B. Read all other Sections of the Specifications, which together with the Drawings and this Section describe the Wall Protection work. Verify all dimensions and conditions at the site.

C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRADES

A. Items furnished under this Section will be installed by other trades unless specifically stated otherwise; furnish installation directions, setting drawings, templates, specifications, and other information required for clear understanding of setting and operation requirements.

1.03 SCOPE OF WORK

A. Work under this Section of the Specifications consists of the furnishing of all labor, materials, equipment, incidentals and the performance of all operations necessary to complete Wall Protection work indicated or reasonably inferred from the Drawings and Specifications.

B. Work Included:
   1. Corner Guards.

1.04 RELATED WORK

A. Section 09 22 00 – Gypsum Wallboard.

B. Section 10 28 00 - Toilet Accessories.
1.05 QUALITY ASSURANCE

A. Performance Requirements:
   1. Fire Performance Characteristics: Provide UL Classified corner guards conforming with NFPA Class A fire rating. Surface burning characteristics, as determined by UL-723 (ASTM E-84), shall be flame spread of 10 and smoke development of 350 - 450. Provide ULC (Canada) listed corner guards conforming to the requirements of the National Building Code of Canada 1990, Subsection 3.1.13. Surface burning characteristics, as determined by CAN/ULC-S102.2, shall be flame spread of 15 and smoke developed of 35.
   2. Impact Strength: Provide rigid vinyl profile materials that have an Impact Strength of 30.2 ft-lbs/inch of thickness as tested in accordance with the procedures specified in ASTM D-256-90b, Impact Resistance of Plastics.
   3. Chemical and Stain Resistance: Provide corner guards and vinyl materials that show resistance to stain when tested in accordance with applicable provisions of ASTM D-543.

B. Anchorage Devices:
   1. Furnish anchoring devices and inserts, which must be installed in other work to secure work of this Section. Coordinate delivery with other work to avoid delay.
   2. Coordinate locations of wall protection devices with locations of other work to avoid interference of these items.

C. Acceptable Manufacturers:
   1. Arden Architectural Specialties
   2. Balco, Inc.
   3. IPC

1.06 SUBMITTALS

A. Make submittals in accordance with Section 01 33 00.

B. Prior to start of fabrication, submit:
   1. Manufacturer's technical data and installation instructions for each specialty item proposed for use.
   2. Setting drawings, templates, instructions, and directions for installation of anchorage devices in wood or metal stud partitions.
   3. Samples: Verification samples of corner guard, 8" (203mm) long, rigid vinyl sheet 8” x 8” in full size profiles of each type and color indicated.

1.07 DELIVERY, STORAGE AND HANDLING

A. Do not deliver wall protection devices to site until areas in which they are to be installed are ready to receive them.

B. Pack items individually in a manner to protect materials and finishes.
PART 2 - PRODUCTS

2.01 QUALITY STANDARDS – CORNER GUARDS

A. Size: Premolded Corner guard of .080" (2mm) thickness shall be extruded from chemical and stain resistant polyvinyl chloride with the addition of impact modifiers, 3" x 3" x 48" unless otherwise shown, In Pro Corporation Model No. 150.

B. Continuous aluminum retainer of .070" (1.8mm) thickness shall be fabricated from 6063-T5 aluminum, with a mill finish.

C. Top caps and bottom caps shall be made of injection molded thermoplastics.

D. Fasteners: All mounting system accessories appropriate for substrates indicated on the drawings shall be provided.

E. Color: As selected by Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions in which the corner guard systems will be installed.
   1. Complete all finishing operations, including painting, before beginning installation of corner guard system or rigid vinyl sheet materials.

B. Wall surface shall be dry and free from dirt, grease and loose paint.

3.02 INSTALLATION – CORNER GUARD

A. Position the aluminum retainer against the wall, allowing 5/16" (8mm) from the bottom of the aluminum to the top of the cove base or baseboard for the bottom cap.

B. Locate corner guard at all exterior corners in corridors or as shown on the drawings.

C. Aluminum Retainer Installation
   1. Drywall installation: Secure the aluminum retainer to the wall using 1-1/4" phillips round head self-tapping screws. Use 4 screws per 3' (.91m) length, 6 screws per 4' (1.22m) length, 10 screws per 8' (2.44m) length, or 12 screws per 9' (2.74m) length. The aluminum retainer is pre-slotted to aid in the installation.

   2. Concrete installation: Drill 1/4" holes into the ends of the retainer for top and bottom caps. Use the slotted tabs of the top caps as a template for hole location. Transfer the location of all mounting holes to the wall. Drill 1/4" (6.5mm) holes and position ALLIGATOR anchors into the holes on the wall. Mount the retainer with #10 x 1-3/4" phillips pan head screws and tighten to secure the retainer to the wall.

D. Top and Bottom Cap Installation
   1. Drywall installation: Overlap the aluminum with the mounting tabs of the top cap and attach them to the aluminum retainer using two, 1-3/4" phillips flat head self tapping screws per cap.
2. Concrete installation: Overlap the aluminum with the mounting tabs of the top and bottom caps and attach them to the aluminum retainer using two, #8 x 1-1/2" phillips flat head screws per cap. When installing flexible top caps on custom angle corner guards, use cup washers and flat head screws to fasten the top caps to the retainer.

E. Position the vinyl cover on the aluminum retainer to check the fit. Adjust the top cap on the aluminum retainer to obtain a tight fit with the vinyl cover. Starting at the top, push the vinyl cover over the aluminum, by pressing over the length until the vinyl snaps securely into place.

3.04 CLEANING

A. At completion of the installation, clean surfaces in accordance with the manufacturers clean-up and maintenance instructions.

END OF SECTION
SECTION 10 44 00 - FIRE EXTINGUISHER CABINETS AND FIRE EXTINGUISHERS

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1 - General Requirements, govern work under this Section whether attached hereto or not.

B. Read all other Sections of the Specifications, which together with the Drawings and this Section describe the Fire Extinguisher Cabinets and Fire Extinguishers work. Verify all dimensions and conditions at the site.

C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRADES

A. Items furnished under this Section will be installed by other trades unless specifically stated otherwise; furnish installation directions, setting drawings, templates, specifications, and other information required for clear understanding of setting and operation requirements.

1.03 SCOPE OF WORK

A. Work under this Section of the Specifications consists of the furnishing of all labor, materials, equipment, incidentals and the performance of all operations necessary to complete Fire Extinguisher Cabinets and Fire Extinguishers work indicated or reasonably inferred from the Drawings and Specifications.

B. Work Included:
   1. Fire extinguisher cabinets.
   2. Fire extinguishers.

1.04 RELATED WORK

A. Section 09 22 00 – Gypsum Wallboard.

1.05 QUALITY ASSURANCE

A. Work of this Section shall comply with applicable requirements of the Texas Architectural Barriers Act, as identified in the Texas Government Code, Chapter 469, Elimination of Architectural Barriers and with the Americans with Disabilities Act (ADA).
B. Anchorage Devices:
   1. Furnish anchoring devices and inserts, which must be installed in other work to secure work of this Section. Coordinate delivery with other work to avoid delay.
   2. Coordinate locations of fire extinguisher cabinets and fire extinguishers with locations of other work to avoid interference and to assure proper operation and servicing of these items.

C. Acceptable Manufacturers:
   CABINETS
   1. Norris Industries, Fire & Safety Equipment Division.
   2. J.L. Industries.

   FIRE EXTINGUISHERS
   1. Amerex Corporation.

1.06 SUBMITTALS

A. Make submittals in accordance with Section 01 33 00.

B. Prior to start of fabrication, submit:
   1. Manufacturer's technical data and installation instructions for each specialty item proposed for use.
   2. Setting drawings, templates, instructions, and directions for installation of anchorage devices in concrete and masonry and for wood blocking in wood or metal stud partitions.
   3. Samples of accessory items, if requested. Submitted items may be used in the work if acceptable.

1.07 DELIVERY, STORAGE AND HANDLING

A. Do not deliver fire extinguisher cabinets and fire extinguishers to site until areas in which they are to be installed are ready to receive them.

B. Pack items individually in a manner to protect materials and finishes.

1.08 PROTECTION

A. During installation of work of this Section, protect adjacent finished work from damage.
PART 2 - PRODUCTS

2.01 QUALITY STANDARDS

A. Furnish the following Fire Extinguisher Cabinets and Fire Extinguishers. Refer to drawings for quantity and locations.

B. F.E.C. - Fire Extinguisher Cabinets shall be semi-recessed type, No. C2409-6R, 2-1/2” rolled edge trim, 18 ga. steel with color epoxy finish, contemporary style steel door and trim, with full panel bubble glazing and red letters “FIRE EXTINGUISHER” as manufactured by Larsen’s Manufacturing Company. Cabinets are located on the Drawings. Provide Fire rated-FS Type at locations in fire rated corridors.
   1. Furnish one (1) Amerex Model #441 or equal 10 lb., Dry Chemical (ABC) fire extinguisher, UL 4A-60-BC, FM approved for each Fire Extinguisher Cabinet as shown on the drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install fire extinguisher cabinets in locations shown on drawings.

B. Install cabinets in openings prepared by others in accordance with the manufacturer's printed instructions.

C. Verify prior to shipment that wall thickness is appropriate for installation of specified cabinets.

D. Mounting heights:
   1. FEC: 4'-8" AFF to top of cabinet

END OF SECTION
SECTION 11 52 00 - PROJECTION SCREENS

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1 - Special Requirements, govern work under this Section whether attached hereto or not.

B. Read all other Sections of the Specifications, which together with the Drawings and this Section describe the Projection Screen work. Verify all dimensions and conditions at the site.

C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRADES

A. Items furnished under this Section will be installed by other trades unless specifically stated otherwise; furnish installation directions, setting drawings, templates, specifications, and other information required for clear understanding of setting and operation requirements.

1.03 SCOPE OF WORK

A. Work under this Section of the Specifications consists of the furnishing of all labor, materials, equipment, incidentals and the performance of all operations necessary to complete the Projection Screen work indicated or reasonably inferred from the Drawings and Specifications.

B. Work Included:
   1. Projection Screens.

1.04 RELATED WORK

A. Section 05 50 00 - Miscellaneous Metals.

B. Section 09 25 00 – Gypsum Board Ceilings.

1.05 QUALITY ASSURANCE

A. Attachment Devices:
   1. Furnish anchoring devices and inserts, which must be installed in other work to secure work of this Section. Coordinate delivery with other work to avoid delay.
   2. Coordinate accessory locations of other work to avoid interference and to assure proper operation and servicing of accessory units.

B. Acceptable manufacturers:
   1. Da-Lite Screen Co., Inc.
2. Radiant Screen and Sales.
3. Draper Screen Co.

1.06 SUBMITTALS

A. Make submittals in accordance with Section 01 33 00.
B. Submit for Architect's approval; samples of material proposed.

1.07 DELIVERY, STORAGE AND HANDLING

A. Do not deliver projection screens to site until areas in which they are to be installed are ready to receive them.

PART 2 - PRODUCTS

2.01 QUALITY STANDARDS

A. Projection Screen - Equal to Da-Lite, “Advantage Electrol” Projection Screen Assembly.

B. Description:
   1. Size: 105" x 140".
   2. Screen surface: flame retardant, mildew resistant, non-glass matte white surface with black masking borders.
   3. Case: aluminum and steel with automatic aluminum powder coated door.
   4. Hanging Brackets: Heavy-duty metal brackets to be supplied for mounting screen from structure above.
   5. Controls – Integrated low voltage control unit with 3 position control switch and cover plate (stainless steel required).
   6. Accessories - “Extra-drop” as required to lower screen to proper position.

PART 3 - EXECUTION

3.01 PREPARATION

A. Provide miscellaneous steel framing above ceiling to suspend projection screen in location shown on the drawings.

3.02 INSTALLATION

A. Install screen in accordance with manufacturer's instructions. Screen shall be adjusted and set at proper height and shall retract smoothly.

B. Install front projection screens with screen cases in position and relationship to adjoining construction as indicated, securely anchored to supporting substrate, and in manner that produces a smoothly operating screen with plumb and straight vertical edges and plumb and flat viewing surfaces when screen is lowered.
C. Test electrically operated units to verify that screen, controls, limit switches, closure and other operating components are in optimum functioning condition.

3.03 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION
SECTION 11 52 23 – MOTORIZED PROJECTOR LIFTS

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1 - Special Requirements, govern work under this Section whether attached hereto or not.

B. Read all other Sections of the Specifications, which together with the Drawings and this Section describe the Motorized Projector Lift work. Verify all dimensions and conditions at the site.

C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRADES

A. Items furnished under this Section will be installed by other trades unless specifically stated otherwise; furnish installation directions, setting drawings, templates, specifications, and other information required for clear understanding of setting and operation requirements.

1.03 SCOPE OF WORK

A. Work under this Section of the Specifications consists of the furnishing of all labor, materials, equipment, incidental and the performance of all operations necessary to complete the Motorized Projector Lift work indicated or reasonably inferred from the Drawings and Specifications.

B. Work Included:
   1. Motorized Projector Lift.

1.04 RELATED WORK

A. Section 05 50 00 - Miscellaneous Metals.

B. Section 09 22 00 - Gypsum Board Drywall

C. Section 09 51 00 - Acoustical Ceilings.

1.05 QUALITY ASSURANCE

A. Attachment Devices:
   1. Furnish anchoring devices and inserts, which must be installed in other work to secure work of this Section. Coordinate delivery with other work to avoid delay.
   2. Coordinate accessory locations of other work to avoid interference and to assure proper operation and servicing of accessory units.
3. The projection lift's supporting structure may require bracing if (1) it exceeds 2 feet (from the support structure to the lift's top mounting holes) or (2) for safe use in seismic or other strenuous environments depending on weight, project location, and installation details.

B. Acceptable manufacturers:
   1. Chief Manufacturing.
   2. Da-Lite.
   3. Draper Inc.

1.06 SUBMITTALS

A. Make submittals in accordance with Section 01 33 00.

B. Submit Manufacturers' latest data sheets/specifications for each type of lift specified indicating model type, major dimensions and finishes for all applicable accessories.

C. Submit shop drawings showing layout and types of projector lifts. Show details of manufacture and installation including vertical height requirements inside the false ceiling (if applicable) for the lift, projector & accessories, ceiling opening dimensions, suggested supporting structure, power requirement and electrical wiring. Take field measurements where possible to assure proper fitting of the work.

D. Submit manufacturer's written technical information and installation instructions in compliance with specification requirements.

1.07 DELIVERY, STORAGE AND HANDLING

A. Do not deliver projector lift to site until areas in which they are to be installed are ready to receive them.

B. Protect products from damage during delivery, handling, storage and installation. Products must be delivered in manufacturer's original containers.

PART 2 - PRODUCTS

2.01 QUALITY STANDARDS

A. Motorized Projector Lift - Model SVS 7-9 lift, Electrically operated scissor projector lift to lower projector from a storage position to a show position for operation and a service position for service. Provide with a 24vac low voltage controller and a standard video cable management system (either retainers or retractors located in the rear of the lift.

B. Description:
   1. Size: 37” Wide x 45” Deep x 16” High.
   2. 165 lbs. Net weight [Shipping weight: 255 lbs.].
4. Low Voltage: 24VAC- Low voltage control with switch control- Security key switch for an authorized person to operate the lift in service and show position supplied with 75' of LV cable.
5. Current Draw: 1.5 Amps
6. Dual power relays with solid state motor control capable of breaking both sides of the AC line to motor
7. Show position adjustable anywhere from the top limit to the lower limit of the lift with an accuracy of +/-1/8”
8. Low voltage control delay between direction changes of motor.
9. Protective circuit so only one direction can be activated at any time, with the other direction locked out if an additional command is sent from an external source
10. All steel construction.

C. Lift Accessories
   1. Open Ceiling Installation - Protective metal enclosure fabricated from steel and aluminum for lift and projector installed below ceiling. Custom built to projector dimensions.

PART 3 - EXECUTION

3.01 PREPARATION
   A. Provide miscellaneous steel framing above ceiling to suspend projector lift in location shown on the drawings.

3.02 INSTALLATION
   A. Install projector lifts at locations indicated in approved shop drawings and in compliance with manufacturer's instructions.
   B. Install projector lift in position and relationship to adjoining construction as indicated, securely anchored to supporting substrate, and in manner that produces a smoothly operating lift with plumb and straight vertical edges and plumb and flat image on viewing surfaces when lowered.
   C. Test electrically operated units to verify that lift, controls, limit switches, closure and other operating components are in optimum functioning condition.
   D. Demonstrate operation of lifts to Owner's designated representatives

3.03 PROTECTION
   A. Protect projector lifts during and after installation from damage from other construction.
   B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION
SECTION 12 24 13 – ROLLER SHADES

PART 1 - GENERAL

1.01 GOVERNING PROVISIONS

A. Applicable provisions of the General Conditions, Supplementary General Conditions, and Division 1 - General Requirements, govern work under this Section whether attached hereto or not.

B. Read all other Sections of the Specifications, which together with the Drawings and this Section describe the Roller Shade work. Verify all dimensions and conditions at the site.

C. Reference to the term "Contractor" shall be construed as the Contractor for this Section of the work except as herein specifically stated otherwise.

1.02 RELATIONS WITH OTHER TRADES

A. Items furnished under this Section will be installed by other trades unless specifically stated otherwise; furnish installation directions, setting drawings, templates, specifications, and other information required for clear understanding of setting and operation requirements.

1.03 SCOPE OF WORK

A. Work under this Section of the Specifications consists of the furnishing of all labor, materials, equipment, incidentals and the performance of all operations necessary to complete the Roller Shade work indicated or reasonably inferred from the Drawings and Specifications.

B. Work Included:
   1. Roller shades.
   2. Black out shades

1.04 QUALITY ASSURANCE

A. Acceptable manufacturers:
   1. Levolor Corporation.

1.05 SUBMITTALS

A. Make submittals in accordance with Section 01 33 00.

B. Prior to placing material order, submit:
   1. Product manufacturer's technical data and installation instructions for type of blind proposed for use.
2. Shop drawings showing field measured dimensions of openings scheduled to receive roller shades. Include details of any special components required that are not in manufacturer's product data and details of head, sill and edge or corner conditions.
3. Samples of colors available for Architect's selection.

PART 2 - PRODUCTS

2.01 QUALITY STANDARDS

A. Basis of design to be automatic roller shades as manufactured by Hunter Douglas Contract in accordance with the following:

1. Fabrics: Inherently anti-static, flame retardant, fade and stain resistant, light filtering, room darkening, & blackout fabrics providing 0% - 15% openness factors. Fabric weights to range between 6.00 oz/sq.yd. – 20.70 oz/sq.yd. containing fiberglass, PVC, polyester, acrylic, vinyl laminates, cotton, & vinyl coatings. Finish selected by architect from manufacturer’s available contract colors.

2. Control System: Adjustment-free continuous qualified #10 stainless steel ball chain ((90-lb. test)) and pulley clutch operating system allows precise control and ensures a uniform look. Clutch will develop no more than ½ pound drag for ease of lifting. Glass reinforced polyester thermopolymer (PBT) plastic components conform to military specification MIL M-24519 and designed for smooth, trouble-free operation.

3. Roller: Circular-shaped painted extruded aluminum tubes with thicker wall & ribs provide additional strength while locking into place the clutch & end plug. 3” outside diameter extruded tube to have a .090 wall thickness. 2” outside diameter extruded tube to have a .072” wall thickness (1 ½” & 1 1/8” tubes have .055” wall thickness) providing strength & durability.

4. End Plug: Heat stabilized fiber reinforced plastic outside sleeve and center shaft provide bearing surfaces on which the roller rides ensuring smooth, wear resistant operation.


6. Mounting Hardware: Manufacturer’s standard .07” nickel-plated, C1008/1010 cold rolled steel universal brackets including end plug bracket with lock down retainer device.

7. Fascia: Pre-finished extruded cover to conceal rollers shade and operating mechanisms. Extruded aluminium alloy 6063-T5, pre-finished, 105 mm x 10 mm x 1.6 mm wall thickness (4.13" x 0.394" x 0.063"), custom designed closure to fit onto pre-moulded end mounting brackets without exposed fasteners. Color pre-finished to match adjacent window framing

8. Room Darkening Side and Bottom Channel:

1. Continuous extruded aluminium alloy, 6063-T5, U-shaped 2” x 0.875” x 0.0625” thick with interior channels for 0.25” wide continuous Schlegel light seals. Color shall be pre-finished to match the adjacent window framing or as selected by the Architect.

2. Custom manufactured for easy snap-on installation, allowing channel to snap into place without exposed fasteners and to be removable without damage to the substrate.

9. Overall width of any one roller shade shall not exceed 10”-0”.

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B. Aluminum Finishes:
   1. All exposed aluminium shall be clear anodized oxide finish according to AA-M12C22A31 or painted to match window framing.
   2. Unexposed aluminium unless otherwise specified: mill finish.

C. Motorized Roller Shades: Provide a Hunter Douglas ST50 Motor (110 V) or equal, for both the room darkening and the black-out shade with remote switch operation. All shades will operate simultaneously with one switch. Refer to drawings for switch location.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Contractor shall be fully responsible for inspecting existing conditions prior to the installation and notifying the Architect, in writing of any condition, which could prevent satisfactory installation.

B. Furnish and install roller shades at all openings, fixed glass, etc. where "RS" is indicated on the Drawings. Roller shades shall cover the entire opening, i.e., fixed glass, operable window, etc. Shade measurements shall be accurate to within $\pm 1/8''$ or as recommended in writing by manufacturer.

C. Install roller shades in manner shown on shop drawings and to comply with manufacturer's instructions. Position units level, plumb, secure, at proper height and location relative to adjoining units and related work. Securely anchor units with proper clips, brackets, anchorages, suited to type of mounting indicated.

D. Divisions between roller shades will be permitted only at mullions at continuous windows or openings where more than one blind for one opening occurs, unless otherwise directed.

E. Protect installed units to ensure their being in operating condition, without damage, blemishes, or indication of use at completion of project. Repair or replace damaged units as directed by Architect.

3.02 CLEAN-UP

A. Remove all empty cartons, containers, discarded blinds, rags, and other trash resulting from these operations.

END OF SECTION
SECTION 21 00 55

BASIC FIRE SUPPRESSION MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following basic Fire Suppression materials and methods to complement other Fire Suppression Sections.
   1. Piping materials and installation
   2. Escutcheons.
   3. Sleeves.
   4. Mechanical sleeve seals.
   5. Installation requirements common to equipment specification sections.
   7. Painting and finishing.

B. Pipe and pipe fitting materials are specified in Plumbing piping system Sections, if applicable.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

A. Product Data: For escutcheon, sleeves, and mechanical sleeve seals.

1.4 QUALITY ASSURANCE
A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate Fire Suppression equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for plumbing installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate connection of Fire Suppression systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

F. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Mechanical Sleeve Seals:
      a. Calpico, Inc.
      b. Metraflex Co.
      c. Thunderline/Link-Seal.

2.2 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.

   1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe materials and size of pipe.
   2. Pressure Plates: Stainless steel.
   3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 PIPING SPECIALTIES

A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
   1. Steel Sheet Metal: 16 gage, galvanized, round tube closed with welded longitudinal joint.
   2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.

B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.
   1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
   2. OD: Completely cover opening.
   3. Cast Brass: One piece, with set screw. (split face acceptable for existing piping)

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS AND APPLICATIONS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual piping Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump
sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's written instructions.

N. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Specification Section "Penetration Firestopping" for firestop materials and installations.

1. Fire-stop all sleeves at floor penetrations of multistory buildings including underfloor penetrations.

3.2 ESCUTCHEON REQUIREMENTS

A. Install escutcheons at pipe penetrations of walls, ceilings, and floors in finished areas.

1. Escutcheons for New Piping:
   a. Piping exposed through floors and walls in finished areas: One piece, cast brass with polished chrome-plated finish with set screw. Deep escutcheons to be provided where standard depth will not fit.
   b. Escutcheons shall cover entire hole penetration.
   c. Escutcheon to be appropriately sized for pipe.

2. Escutcheons for Existing piping:
   a. Piping exposed through floors and walls in finished areas: Split plate, cast brass with polished chrome-plated finish with set screw. Deep escutcheons to be provided where standard depth will not fit.
   b. Escutcheons shall cover entire hole penetration.
c. Escutcheon to be appropriately sized for pipe.

3. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.3 PIPE SLEEVE INSTALLATION REQUIREMENTS

A. Sleeves are required for all through floor and wall penetrations. Sleeves to be set and poured in place (in slab applications), secure all sleeves with fasteners. Sleeves to extend 2 inches past face of floor or wall. Pipe sleeve in finished areas to be flush with wall or floor for installation of escutcheon. Install sleeves in new partitions, slabs, and walls as they are built.

B. Pipe sleeves are required at all through wall and floor penetrations.

C. Install sleeve materials according to the following applications:
   1. Sleeves for Piping Passing through Concrete Floor Slabs: galvanized steel pipe.
   2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe sleeves.
      a. Extend sleeves 2 inches above finished floor level.
      b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
   c. Sleeves for Piping Passing through Gypsum-Board Partitions:
      1) Galvanized-steel pipe sleeves, or galvanized-steel sheet metal sleeve.
      2) Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
   d. Sleeves for Piping Passing through Concrete Roof Slabs: Reference Structural/Architectural details.
   e. Sleeves for Piping Passing through Concrete Walls:
      1) Galvanized-steel pipe sleeves.
      2) Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.

D. Ratproofing: The open space around all piping, ductwork, etc. passing through the ground floor and/or exterior walls shall be ratproofed in a manner acceptable to the Owner’s Representative.

E. Mechanical sleeve seals
   1. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building. Sleeves must be poured in place. Installation of sleeves after wall is constructed is not acceptable.
2. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.
   a. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated. Seal annular space with water tight sealant (equal to NP-1). All sleeves and penetrations to maintain rating of wall/floor. Seal pipe penetrations with fire-stopping materials.

F. Piping Connections: Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
   2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.

3.4 EQUIPMENT INSTALLATION – COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

E. Install equipment giving right of way to piping installed at required slope.

3.5 PAINTING AND FINISHING

A. Apply paint to exposed piping according to the following, unless otherwise indicated:
   1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
   2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.

5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.


B. Do not paint piping specialties with factory-applied finish.

C. Extend paint up to, not including, sprinkler heads.

D. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 DEMOLITION

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for Fire Suppression installations. Perform cutting by skilled mechanics of trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.7 CUTTING AND PATCHING

A. Disconnect, demolish, and remove Work specified in Fire Suppression Sections.

B. If pipe or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

D. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches beyond face of adjacent construction. Cap and patch surface to match existing finish.

E. Removal: Remove indicated equipment from Project site.

F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This section covers the general provisions of the fire suppression specifications applicable to the following systems:
   1. Fire Protection.

1.2 DRAWINGS

A. These specifications are accompanied by drawings of the building and details of the installations showing the locations of equipment, piping, etc. The drawings and these specifications are complementary to each other; requirements described in one or the other shall be considered binding as if described in both.

B. If any departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Owner’s Representative for approval. No departures shall be made without prior written approval by the Owner’s Representative.

C. There are intricacies of construction which are impractical to specify or indicate in detail; means and methods for performing such work shall adhere to commonly accepted industry standards.

D. It is the Contractor’s responsibility to properly use all information found on the Architectural, Structural, Mechanical and Electrical drawings and applicable shop drawings where such information affects his work.

E. For new buildings, all final dimensions shall be scaled from the drawings, unless otherwise noted. For work associated with existing buildings (renovations and additions), all final dimensions shall be field verified.

1.3 CONSTRUCTION REQUIREMENTS

A. The architectural, civil, structural, electrical, plumbing, fire protection and Fire Suppression drawings, and specifications are all part of the Contract Documents. In many instances there are details described another trade's drawings that are not necessarily included or referenced in the fire suppression drawings. It is the Contractor's responsibility to review in detail all parts of the Contract Documents prior to submitting a bid. Failure to comply with this requirement shall not relieve the Contractor of
responsibility or be used as cause for additional compensation because architectural, structural, or electrical details were not included in the fire suppression drawings.

B. It is the intent of the Contract Documents to provide complete and fully functional installation in every respect. Material and/or construction details not specifically described in the Contract Documents, but commonly considered incidental to the industry, are required by the Contractor.

C. The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to avoid all obstructions, to comply with Codes, to facilitate the work of other trades, to conform to the details of the installation supplied by the manufacturer of the equipment to be installed, and thereby to provide an integrated satisfactory operating installation.

D. Final placement of serviceable equipment shall be carefully coordinated with all other trades to ensure sufficient clearance for maintenance according to manufacturer’s recommendations. Lubricating orifices and adjustable components shall be easily accessible. Piping, conduit, valve stems, cabling and other building systems shall not interfere with service space.

E. Location of Exposed Devices
   1. All exposed devices (sprinkler heads, fire risers, pumps, etcetera) shall be referenced to fixed data points that are coordinated with all trades; shall be located to present symmetrical arrangements with respect to the fixed data point; and shall facilitate the proper arrangements of acoustical ceiling tiles. Fixed data points shall include such features as wall and ceiling lines, soffits, balanced border widths, masonry joints, etc. Devices located in acoustical ceiling tiles shall occur symmetrically in tile joints or in the centers of whole tiles. The final determination of the exact location of each outlet and the arrangements to be followed shall be acceptable to the Owner’s Representative.

1.4 QUALIFICATIONS

A. Contractor must have minimum of five years experience installing fire suppression systems similar to those described in these Contract Documents.

B. Contractor must be licensed and hold a current contracting license that has been valid for a minimum of five years in the State of Texas.

C. Contractor must be able to bond work for payment and performance of work being bid. Contractor's bonding agency shall have a Best's insurance rating of A or A+.

1.5 MATERIAL AND EQUIPMENT REQUIREMENTS

A. Manufacturer’s Instructions: The manufacturer’s published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufacturer materials or
equipment, unless otherwise indicated. The Contractor shall promptly notify the Owner's Representative in writing of any conflict between the requirements of the Contract Documents and the manufacturer's direction and shall obtain the clarification of the Owner's Representative before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or such clarification by the Owner's Representative, he shall bear all costs arising in connection with the correction of the deficiencies.

B. Storage at Site: The Contractor shall not receive material or equipment at the jobsite until there is suitable space provided to properly protect equipment from rust, drip, humidity, and dust damage and from surrounding work.

C. Capacities shall be not less than those indicated and shall be such that no component or system becomes inoperative or is damaged because of startup or other overload conditions.

D. Conformance to Agency Requirements: Where materials or equipment are specified to be approved, listed, tested, or labeled by the Underwriters Laboratories, Inc., or constructed and/or tested in accordance with the standards of the American Society of Mechanical Engineers, the Contractor shall submit proof that the items furnished under this section of the specifications conform to such requirements. The label of Underwriters Laboratories, Inc. applied to the item will be acceptable as sufficient evidence that the items conform to such requirements. The ASME stamp or the AMCA label will be acceptable as sufficient evidence that the items conform to the respective requirements.

E. Nameplates: Each major component of equipment shall have the manufacturer's name, address, and model-identification number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Inspection.

F. Prevention of Rust: Standard factory finish will be acceptable on equipment specified by model number; otherwise surfaces of ferrous metal shall be given a rust-inhibiting coating. The treatment shall withstand 200 hours in salt-spray fog test, in accordance with Method 6061 of Federal Standard No. 141. Immediately after completion of the test, the specimen shall show no signs of wrinkling or cracking and no signs of rust creepage beyond 1/8 inch on either side of the scratch mark. Where rust inhibitor coating is specified hereinafter, any treatment that will pass the above test is acceptable unless a specific coating is specified, except that coal tar or asphalt-type coatings will not be acceptable unless so stated for a specific item. Where steel is specified to be hot-dip galvanized, mill-galvanized sheet steel may be used provided all raw edges are painted with a zinc-pigmented paint conforming to Military Specification MIL-P-26915.

G. Protection from Moving Parts: Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts located so that any person can come in close proximity thereto, shall be fully enclosed or properly guarded.
H. Drive Guards: For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears, and other moving parts regardless of height above the floor. Drive guards may be excluded where motors and drives are inside factory-fabricated air handling units casings. Guards shall be constructed of sheet steel, cast iron, expanded metal, or wire mesh rigidly secured so as to be removable without disassembling pipe duct or electrical connection to equipment. Provide a 1-inch diameter hole in each drive guard at each shaft center to allow access for speed measurement.

I. Verifications of Dimensions: The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, to verify all dimensions in the field, and to advise the Owner’s Representative of any discrepancy before performing any work. Adjustments to the work required in order to facilitate a coordinated installation shall be made at no additional cost to the Owner, Architect, or Engineer.

J. Standard Products: Materials and equipment to be provided shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications, and shall essentially duplicate materials and equipment that have been in satisfactory use at least two years.

1.6 INSPECTION OF THE SITE

A. The Contractor shall visit the site, verifying all existing items indicated on drawings and/or specified, and familiarize himself with the existing work conditions, hazards, grades, actual formations, soil conditions, structures, utilities, equipment, systems, facilities, and local requirements. The submission of bids shall be deemed evidence of such visits. All proposals shall take these existing conditions into consideration, and the lack of specific information shall not relieve the Contractor of any responsibility.

1.7 UTILITY LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work have been obtained from substantially reliable sources and are offered separately from the Contract Documents, as a general guide only, without guarantee as to accuracy. Examine the site, the locations, and availability of all utilities and services required for their relation to the work. Verify the location of all existing site utilities with each responsible utility company or applicable party. The Contractor shall repair all damage to existing utilities, whether indicated on the drawings or not, at his sole expense.

1.8 PERMITS, UTILITY CONNECTIONS, AND INSPECTIONS

A. Permitting Fees: Contractor shall pay for all fees associated with permits required by municipal authorities having jurisdiction.
B. Tapping and Impact Fees: Contractor shall pay for all fees associated with tapping into municipal utility mains, including domestic water. Impact fees will be paid for by the Owner.

C. Compliance: The Contractor shall comply in every respect with all requirements of local authorities having jurisdiction, including building inspections, fire marshal, local ordinances and codes, and utility company requirements. In no case does this relieve the Contractor of the responsibility of complying with these specifications and drawings where specified conditions are of a higher quality than the requirements of the above-specified authorities. Where requirements of the specifications and drawings are below the requirements of the above offices having jurisdiction, the Contractor shall make installations in compliance with the requirements of the above authorities.

D. Utilities: The Contractor shall coordinate with the various utility companies involved in this project and shall provide required utility relocations, extensions, modifications, and/or changes (complete in all respects) as described in the Contract Documents. Contractor shall verify the location of all existing utilities with the applicable Utility Company. The Contractor shall be responsible for all damages to existing utilities, whether indicated on drawings or not, and repair all damage to existing utilities as acceptable to the affected Utility Company.

E. Certification: Prior to final acceptance, the Contractor shall furnish a certificate of acceptance from the inspection departments having jurisdiction over the work for any and all work installed under this Contract. Any additional labor costs incurred as a result of a substitution shall be the Contractor's responsibility.

1.9 EXISTING FACILITIES

A. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection, and in-service maintenance of all plumbing, heating, air conditioning, and ventilating services for the new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work.

B. The Contractor shall provide temporary or new services to all existing facilities as required to maintain their proper operation when normal services are disrupted as a result of the work being performed under this project.

C. Outages of services as required by the new installation will be permitted but only at a time approved by the Owner. The Contractor shall allow the Owner two weeks in order to schedule required outages. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including overtime charges, shall be included in the contract amount.
1.10 DEMOLITION AND RELOCATION

A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination or otherwise disposed of as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

B. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the Contractor's responsibility and shall be repaired or replaced by the Contractor as approved by the Owner, at no additional cost to the Owner.

D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as hereinbefore specified.

1.11 SUBSTITUTION OF MATERIALS AND EQUIPMENT

A. No substitution of materials or equipment herein specified or called for on the drawings will be permitted, except by written permission of the Owner's Representative. Where several makes of equipment or material are mentioned, any item named may be bid upon provided it meets space, capacity specifications, and other requirements.
1. As soon as practical or within 30 days after the date of contract award or notice to proceed, and before purchasing or starting installation of any materials or equipment, the Contractor shall submit for review sufficient material and equipment data to indicate that all requirements of the specifications have been met and samples shall be furnished when requested. All manufacturer's data used as part of the submittal shall have all non-applicable features crossed out or deleted in a manner that will clearly indicate exactly what is to be furnished.

2. Four (4) copies of the submittal list and detailed submittals (for the Owner's and A/E's use) shall be submitted to the Owner's Representative. The Contractor is requested to include a minimum of three (3) additional copies for insertion in the project's Owner's Manuals at the completion of the project, and the number of additional copies the Contractor requires for his and his subcontractor's use during the project's construction. The detailed submittals shall be accompanied by the same number of sets of pictorial and descriptive data derived from the manufacturer's catalogs and sales literature, or incorporated in the shop drawings. The Contractor may provide a detailed submittal on any item even though not required by the Owner's Representative.

B. Format
1. Submittals shall in pdf format. The front sleeve shall have a cover sheet with the title "FIRE SUPPRESSION SUBMITTALS" centered in large print. Below the title shall be the name of the project, the date, the project location, the name and address of the contractor, the name and address of the subcontractor and the name and address of the engineer(s) in smaller print.
2. Provide a Table of Contents that summarizes the information being submitted according to specification section.
3. Submittals shall be tab divided by specification section; all sections identified in the project specifications shall have a tab. When no information is being provided concerning a particular specification section, insert a single dated sheet that explains the circumstances.

C. Content:
1. The Contractor shall prepare or cause to be prepared shop drawings, product data, materials and equipment lists, diagrams, data, samples, and other submittals as required by the contract documents, hereinafter referred to as “Submittal Data.” The Contractor shall review and approve all submittal data for compliance with the contract documents, manufacturer's recommendations, adequacy, clearances, code compliance, safety, and coordination with associated work.

2. The Contractor shall submit approved submittal data to the Owner's Representative for review and comment as to general conformance with the design concept and general compliance with information given in the contract documents. Owner's Representative's review shall not include review of quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with other trades or work, or construction safety and precautions, all of which are the sole responsibility of the Contractor.
3. The Contractor shall clearly and specifically identify and call to the attention of the Owner's Representative any deviation from the contract documents for which Owner acceptance is desired. The responsibility for such a deviation accepted by the Owner shall remain with the Contractor.

4. Timeliness: The burden of timeliness in the complete cycle of submittal data is on the Contractor. The Contractor shall allow a minimum of two (2) weeks' time frame for review of each submission by the Owner's Representative. The Contractor is responsible for allowing sufficient time in the construction schedule to cover the aforementioned cycles of data processing, including time for all re-submission cycles on nonconforming materials, equipment, etc. covered by the data submitted. Construction delays and/or lack of timeliness in the above regard are the responsibility of the Contractor and will not justify any request for scheduled construction time extensions or extra compensation.

5. Work performed in accordance with approved submittal data that is not in accordance with the Contract Documents and did not have the specific acceptance of the Owner's Representative shall be replaced at Contractor's cost.

D. Re-submittals
1. Re-submit entire submittal in accordance with afore mentioned format and content requirements. Loose-leaf or piecemeal re-submittals are not acceptable. New and/or revised data for each section shall be prefaced with a colored (yellow, pink, orange, etc) cover sheet that identifies (in a word or two) the materials and/or equipment being re-submitted. Typeset the words "REVISED SUBMITTAL NO. 1 (or 2, 3 as applicable)" centered at the bottom of the cover sheet.

2. Subsequent re-submittals (second and third, if necessary) shall have different colored cover sheets to distinguish between the various re-submittals.

3. Include a cover letter at front of binder that specifically responds to each “REVISE AND RE-SUBMIT COMMENT” or “REJECTED” comment by number. Example responses would include the following:
   a. RESPONSE: “Please see attached re-submittal.”
   b. RESPONSE: “Will be re-submitted at a later date.”
   c. RESPONSE: “Requirement for (xxxxxx) was deleted in Addendum No. 2.”
   d. RESPONSE: “Exception requested based on Section xx, Paragraph x.x.x.”

E. These paragraphs related to Fire Suppression submittal data supersede any conflicting requirements contained in Division 01 sections.

1.13 ACCEPTANCE OF MATERIALS AND EQUIPMENT

A. All equipment installed on this project shall have local (within 125 miles) representation, local factory-authorized service, and a local stock of repair parts. This requirement is essential and will be strictly reviewed by the Owner's Representative prior to concurrence with the Contractor's approval for all submittals covered by Fire Suppression sections of this Specification.
B. NOTICE: The Contractor is responsible for providing materials and equipment that conform to the requirements of the project manual in every respect unless a deviation has been "accepted" in writing. Removal of any nonconforming materials and equipment and the replacement with conforming materials and equipment shall be at the Contractor's sole expense, regardless of when nonconformance was discovered.

C. Approval of materials and equipment shall be based on manufacturer's published data and shall be tentatively subject to the submission of complete shop drawings which comply with the contract documents. Approval is also dependent upon the existence of adequate and acceptable clearances for entry, servicing, and maintenance.

D. Approval of materials and equipment under this provision shall not be construed as authorizing any deviations from the specifications, unless the attention of the Owner's Representative has been directed in writing to the specific deviations. Data submitted shall not contain unrelated information unless all pertinent information is properly identified.

E. Physical Size of Equipment: Space is critical; therefore, equipment of larger sizes than shown, even though of approved manufacturer, will not be acceptable unless it can be demonstrated that ample space exists for proper installation, operation, and maintenance.

1.14 SHOP DRAWINGS

A. As soon as practicable after the award of contract and approval of materials and equipment, but prior to installation, complete and detailed shop drawings of the Fire Suppression System shall be submitted for review and comment. The following systems are to be coordinated on the Shop Drawings:
   1. Equipment arrangements.
   2. Duct layouts.
   3. Piping layouts.
   4. Cable Tray.
   5. Sprinkler locations.
   6. Other details as directed by the Owner's Representative. Composite drawings of areas requiring coordination between trades shall be provided and expedited to eliminate conflicts and to ensure maximum cooperation and work progress.

B. Work performed without benefit of reviewed and approved shop drawings will not be recommended for payment by the Engineer until such time as the shop drawings are submitted, reviewed, and approved. Any work performed without the benefit of reviewed and approved shop drawings may require removal, relocation, and/or replacement at the Contractor's sole expense in order to resolve conflicts between the various systems and provide the performance specified.

C. All installation of equipment, fixtures, terminal devices, etc. shall be made in accordance with approved composite shop drawings. The Contractor shall modify installation and relocate installed work to provide code clearances, service access, and eliminate conflict with other systems.
D. Submit approved shop drawings in pdf format.

1.15 SITE OBSERVATION

A. Site observation by the Architect, Engineer, and/or Owner's Representative is for the express purpose of verifying compliance by the Contractor with the contract documents, and shall not be construed as construction supervision nor indication of approval of the manner or location in which the work is being performed as being a safe practice or place.

1.16 SUPERVISION

A. In addition to the Superintendent required under the conditions of the contract, each subcontractor shall keep a competent superintendent or foreman on the job at all times.

B. It shall be the responsibility of each superintendent to study all plans and familiarize himself with the work to be done by other trades. He shall coordinate his work with other trades and, before material is fabricated or installed, make sure that his work will not cause an interference with another trade. Where interferences are encountered, they shall be resolved at the jobsite by the superintendents involved. Where interferences cannot be resolved without major changes to the plans, the matter shall be referred to the Owner's Representative for comments.

1.17 OPERATION PRIOR TO COMPLETION

A. When any piece of mechanical equipment is operable and it is to the advantage of the Contractor to operate the equipment, he may do so, providing that he properly supervises the operation and has the written permission of the Owner's Representative to do so. The warranty period shall not commence, however, until such time as the equipment is operated for the beneficial use of the Owner or date of substantial completion, whichever occurs first.

B. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, properly adjust, and complete all deficiency list items before final acceptance by the Owner. The date of acceptance and the start of the warranty may not be the same date.

1.18 MANUFACTURER'S RECOMMENDATIONS

A. The manufacturer's published directions shall be followed in the delivery, storage, protection, installation, piping, and wiring of all equipment and material. The Contractor shall promptly notify the Owner's Representative, in writing, of any conflict between the requirements of the contract documents and the manufacturer's directions, and shall obtain the Owner's Representative's comments before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's
directions or applicable comments from the Owner's Representative, he shall bear all costs arising in connection with the correction of such deficiencies.

1.19 CHECKING AND TESTING MATERIALS AND/OR EQUIPMENT

A. Before final acceptance of the work, an authorized representative of the manufacturer of the installed materials and/or equipment shall personally inspect the installation and operation of his materials and/or equipment to determine that it is properly installed and in proper operating order. Testing and checking shall be accomplished during the course of the work where required by work being concealed, and at the completion of the work otherwise. In addition, the Contractor shall submit to the Owner's Representative a signed statement from each representative certifying as follows:

1. “I certify that the materials and/or equipment listed below have been personally inspected by the undersigned authorized manufacturer's representative and is properly installed and operating in accordance with the manufacturer's recommendations and are asbestos free.”

1.20 OPERATING AND MAINTENANCE INSTRUCTION

A. The Contractor shall prepare for the owner's manual hereinafter specified complete sets of operating and maintenance instructions, system piping, valving, control and interlock diagrams, manuals, parts lists, etc. for each item of equipment. These are to be assembled as hereinafter specified for owner's manual.

B. In addition, the Contractor shall provide the service of a competent engineer or a technician acceptable to the Owner's Representative to instruct a representative of the Owner in the complete and detailed operation of all equipment and systems. These instructions shall be provided for a period of sufficient duration to fully accomplish the desired results. Upon completion of these instructions, a letter of release will be required, acknowledged by the Owner, stating the dates of instruction and personnel to whom instructions were given.

C. Additional diagrams, operating instructions, etc. shall be provided as specified hereinafter in the other sections of these specifications.

1.21 MATERIAL AND EQUIPMENT SCHEDULES

A. Contractor shall refer to both drawings and specification for schedules. Where reference is made to items “scheduled on drawings” or “scheduled in specifications,” same shall include schedules contained in both the drawings and the specifications. The Contractor's attention is directed to the various specification sections and drawings for schedules.

1.22 APPLICABLE CODES AND STANDARDS
A. The installation shall meet the minimum standards prescribed in the latest editions of the following listed codes and standards, which are made a part of these specifications, except as may be hereinafter specifically modified in these specifications and associated drawings.

1. National Fire Protection Association Standards (NFPA):
   - NFPA 10 - Portable Fire Extinguishers
   - NFPA 13 – Standard for the installation of sprinkler systems.
   - NFPA 54 - National Fuel and Gas Code
   - NFPA 70 - National Electrical Code
   - NFPA 90A - Air Conditioning Systems
   - NFPA 255 - Method of Test of Surface Burning Characteristics of Building Materials
   - 15-78 - Safety Code for Mechanical Refrigeration
   - C.2 - 1984 National Electrical Safety Code
   - A117.1 - Handicapped Code
3. American Society of Mechanical Engineers (ASME): Section IV, V, CSD-1
7. Occupational Safety and Health ACT (OSHA):
   - National Sanitation Foundation - Standard No. 2
8. American Society of Heating, Refrigeration, and Air conditioning Engineers (ASHRAE):
   - 90-80 Energy Conservation in New Building Design
   - 2001 ASHRAE Handbook of Fundamentals
10. American Gas Association (AGA)
11. Underwriters Laboratories, Inc. (UL)
12. Manufacturer's Standardization Society of the Valve and Fitting Industry (MSS)
13. Applicable State Building Codes (International Building Codes, as amended):

B. All materials and workmanship shall comply with all applicable city, state, and national codes, specifications, and industry standards. All materials shall be listed by the Underwriters Laboratories, Inc. as conforming to its standards and so labeled in every
case where such a standard has been established for the particular type of material in question.

C. The contract documents are intended to comply with the aforementioned rules and regulations; however, some discrepancies may occur. Where such discrepancies occur, the Contractor shall immediately notify the Owner's Representative in writing of said discrepancies and apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with said regulations shall be paid for as covered by Division 1 of these contract documents, providing no work or fabrication of materials has been accomplished in a manner of noncompliance. Should the Contractor fabricate and/or install materials and/or workmanship in such a manner that does not comply with the applicable codes, rules, and regulations, the Contractor who performed such work shall bear all costs arising in correcting these deficiencies to comply with said rules and regulations.

1.23 DEFINITIONS

A. Refer to the condition of the contract for Division 1 for additional requirements regarding definitions.

B. Where “as required” or “as necessary” is used in these specifications or on the drawings, it shall mean “that situations exist that are not necessarily described in detail or indicated that may cause the Contractor certain complications in performing the work described or indicated. These complications entail the normal coordination activities expected of the Contractor where multiple trades are involved and new or existing construction causes deviations to otherwise simplistic approaches to the work to be performed. The term shall not be interpreted to permit an option on the part of the Contractor to achieve the end result.”

C. Where “and/or” is used in these specifications or on the drawings, it shall mean “that situations exist where either one or both conditions occur or are required and shall not be interpreted to permit an option on the part of the Contractor.

1.24 FINAL INSPECTION

A. Refer to Division 1 for additional requirements for final inspection.

B. It shall be the responsibility of the Contractor to personally conduct a careful inspection, assuring himself that the work on the project is ready for final acceptance and developing his own “punch lists,” before calling upon the Owner's Representative to make a final inspection. Failure of the Contractor to conduct such inspections and provide the Owner's Representative with a copy of his “punch lists” prior to the final inspection shall be adequate cause for the Owner's Representative to cancel any Contractor-requested final inspection.

C. In order not to delay final acceptance of the work, the Contractor shall conduct his own “final inspections" prior to requesting the Owner's Representative to “final" the project;
will have all necessary bonds, guarantees, receipts, affidavits, etc. called for in the various articles of this specification prepared and signed in advance; and together with a letter of transmittal listing each paper included, shall deliver the same to the Owner's Representative at or before the time of said final inspection. The Contractor is cautioned to check over each bond, receipt, etc. before preparing same for submission to see that the terms check with the requirements of the specifications.

D. The final inspection will be made jointly by the Owner's Representative and the Owner.

1.25 REQUIREMENTS FOR FINAL ACCEPTANCE

A. Requirements for final acceptance shall include but not be limited to the Contractor accomplishing the following:
   1. Construction: Complete all construction.
   2. Deficiency Lists: Correct all deficiencies listed at time of Substantial Completion.
   3. Owner's Manual: Submit at least 30 days prior to final acceptance on (1) copy of the owner's manual for the Owner's Representative's review and comments. Following acceptance, prepare three (3) copies of bound and indexed owner's manual, to be delivered at the time of final acceptance, which shall include but not be limited to the following:
      a. System operating instructions.
      b. System control drawings.
      c. System interlock drawings.
      d. System maintenance instructions.
      e. Manufacturers', suppliers', and subcontractors' names, addresses, and telephone numbers, both local representatives and manufacturers' service headquarters.
      f. Equipment operating and maintenance instructions and parts lists.
      g. Manufacturer's certifications (see Checking and Testing Materials and/or Equipment, this section).
      h. Contractor's warranty.
      i. Acceptance certificates of authorities having jurisdiction.
      j. Log of all tests made during course of work.
      k. Owner's acknowledgment of receipt of instruction, enumerating items in owner's manual.
      l. List of manufacturers' guarantees executed by the Contractor.
      m. Certified performance curves.
      n. Owner's acknowledgment of items of equipment or accessories indicated or specified to be turned over to Owner.

   4. Instructions:
      a. Verbal, as herein specified.
      b. Posted, framed under glass or plastic laminated:
         1) System operating instructions.
         2) System control drawings.
         3) System interlock drawings.
5. Record Drawings: Deliver the specified record drawings to the Owner's Representative.

1.26 RECORD DRAWINGS

A. The Contractor shall maintain a set of contract drawings (black-line prints) at the jobsite on which he shall indicate the installed (as-built) locations.

B. Drawings shall be used for construction reference and shall not leave the field office of the jobsite.

C. Drawings shall include all addenda, ASI's, Change Orders, and existing conditions and equipment that are not reflected in the original contract drawings.

D. Upon completion of work, the Contractor shall obtain CAD files of the contract drawings from the Owner's Representative and transfer the above as-built information into these files. The as-built files shall be permanently marked “RECORD DRAWINGS” and printed on full-size Mylar sheets. Upon completion, the CAD files shall be transferred to CD in AutoCAD 2010 format. Both the CAD files CD and Mylar drawings shall be submitted to the Owner's Representative as part of the Close-out Submittals.

E. Refer to Division 1 paragraph entitled "Record Documents" for additional requirements.

1.27 ALTERNATE PROPOSALS

A. Alternate proposals are summarized in Division 1 and on the bid proposal form. Refer to all sections of the specifications and the drawings to determine the exact extent and scope of the various alternate proposals as each pertains to the work of the various trades.

1.28 WARRANTY

A. General: All work performed (including equipment and materials furnished) under the various sections of these specifications shall be 100% warranted, for a period of one (1) year from the date of final acceptance thereof, against defective materials, design, and unauthorized substitution. Upon receipt of note of failure of any part of the guaranteed equipment and/or facilities during the guaranty period, the affected part(s) or facilities shall be replaced promptly with new parts, etc. by and at the expense of the Contractor. Further, the Contractor shall properly obtain, execute, and forward any and all manufacturer's warranties on equipment furnished under the Contract. Refer to Division 1 for additional requirements.

B. Extended Period: The Contractor shall provide all extended time warranties available from the manufacturer of the equipment provided as standard at no additional cost. This includes all extended warranties where specified with certain equipment as directed in other sections of this Specification.
PART 2 - PRODUCTS

2.1 MATERIALS AND WORKMANSHIP

A. All materials, unless otherwise specified, shall be current United States manufacture, new, free from all defects, and of the best quality. Foreign goods specifically approved for use by the Owner's Representative prior to bidding may be furnished.

B. Materials and equipment shall be installed in accordance with the manufacturer’s recommendations and the best standard practice for the type of work involved. All work shall be executed by mechanics skilled in their respective trades, and the installations shall present a neat, precise appearance.

C. The responsibility for the furnishing and installation of the proper fire suppression equipment and/or material as intended rests entirely upon the Contractor. The Contractor shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.

2.2 FLAME SPREAD AND SMOKE DEVELOPED PROPERTIES OF MATERIALS

A. All materials in concealed locations, including any above-ceiling area, shall have a flame spread rating not over 25 without evidence of continued progressive combustion and a smoke developed rating no higher than 50. Flame spread and smoke developed ratings shall be in accordance with NFPA Standard No. 255.

2.3 FIRE AND SMOKE PARTITION, WALL, AND/OR FLOOR PENETRATIONS

A. Pipe, conduit, etc. shall pass through fire- or smoke-rated floors, partitions, walls, or other barriers within a UL-listed assembly which shall maintain the rating of the applicable wall, floor, partition, or barrier.

B. The Contractor shall review the architectural and structural drawings and determine the location of the fire-rated building elements. Where these elements are penetrated, UL-listed fire-rated penetration assemblies approved by the local authority shall be provided in accordance with the manufacturer's instructions to obtain the required rating.

2.4 FOUNDATIONS / HOUSEKEEPING PADS

A. General: All special foundations and supports required for the proper installation of equipment and pipe shall be provided as hereinafter specified and under the section of the specifications covering the equipment, unless otherwise indicated on the drawings.

B. All equipment shall receive concrete housekeeping pads unless otherwise noted. Equipment to be receive pads are to include (but not limited to): air compressors, fire pumps, etc.
C. Concrete foundations for the support of equipment such as floor-mounted pumps, equipment, etc. shall be not less than 5 1/2 inches high and not less than 4 inches larger (in both directions) than supported unit, unless otherwise noted and shall be poured in forms built of new dressed lumber. All corners of the foundations shall be neatly chaffered by means of sheet metal or triangular wood strips nailed to the form. Pads shall not be laid out directly against walls or structures. 2 inches shall be left available for pad form work. Foundation bolts shall be placed in the forms when the concrete is poured, the bolts being correctly located by means of templates. Allow 1 inch below the equipment bases for alignment and grouting (where applicable). Foundations for equipment located on the exterior of the building shall be provided as indicated. Foundations shall be constructed in accordance with approved shop drawings and shall be reinforced with #4 bars at 12 inches on center both ways (minimum).

2.5 FLOOR AND CEILING PLATES

A. Except as otherwise noted, provide one-piece chrome-plated brass floor and ceiling plates (or escutcheons) around all pipes, conduits, etc. passing through walls, floors, or ceilings in any spaces, except underfloor and attic spaces. Plates shall be sized to fit snugly against the outside of the pipe or against the outside of insulation on lines which are insulated, and positively secured to such pipe or insulation. Plates will not be required for piping where pipe sleeves extend ¾ of an inch above finish floor and are concealed. Plates shall be one piece.

PART 3 - EXECUTION

3.1 SPACE AND EQUIPMENT ARRANGEMENT

A. The size of equipment indicated on the drawings is based on the dimensions of a particular manufacturer. While other manufacturers will be acceptable, it is the responsibility of the Contractor to determine whether the equipment he proposes to furnish will fit in the space. Shop drawings shall be prepared when required by the Owner's Representative to indicate a suitable arrangement.

B. All equipment shall be installed in a manner to permit access to all surfaces.

3.2 PROTECTION

A. The Contractor shall take such precautions as may be necessary to properly protect all materials and equipment from damage from the time of delivery until the completion of work. This shall include the erection of all required temporary shelters and supports to adequately protect any items stored in the open on the site from the weather, the ground and surrounding work; the cribbing of any items above the floor of the construction; and the covering of items in the uncompleted building with tarpaulins or other protective covering. Failure on the part of the Contractor to comply with the above will be sufficient cause for the rejection of the items in question.
B. The Contractor shall protect existing facilities, the work of others, and the premises from any and all damages that may be made possible by the execution of work.

C. Equipment and materials shall be protected from rust both before and after installation. Any equipment or materials found in a rusty condition at the time of final inspection must be cleaned of rust and repainted as specified elsewhere in these specifications.

3.3 COOPERATION BETWEEN TRADES AND WITH OTHER CONTRACTORS

A. Each trade, subcontractor, and/or Contractor must work in harmony with the various trades, subcontractors, and/or Contractors on the job as may be required to facilitate the progress to the best advantage of the job as a whole. Each trade, subcontractor, and/or Contractor must pursue its work promptly and carefully so as not to delay the general progress of the job. This Contractor shall work in harmony with Contractors working under other contracts on the premises.

B. It shall be the responsibility of each trade to cooperate fully with the other trades on the job to help keep the jobsite in a clean and safe condition. At the end of each day's work, each trade shall properly store all of its tools, equipment, and materials and shall clean its debris from the job. Upon the completion of the job, each trade shall immediately remove all of its tools, equipment, any surplus materials, and all debris caused by its portion of the work.

3.4 PRECEDENCE OF MATERIALS AND COORDINATION OF WORK

A. These specifications and the accompanying drawings are intended to cover systems which will not interfere with the structural design of the building, which will fit into the several available spaces, and which will ensure complete and satisfactory systems. Each subcontractor and/or trade shall be responsible for the proper fitting of his material and apparatus into the building.

B. The work of the various trades shall be performed in the most direct and workmanlike manner without hindering or handicapping the work of other trades. Piping interferences shall be handled by giving precedence to pipe lines which require a stated grade for proper operation. Where space requirements conflict, the following order or precedence shall, in general, be observed:

1. Building lines.
2. Structural members.
3. Light fixtures.
4. Soil and drain piping.
5. Condensate drains.
6. Vent piping.
7. Supply, return, and outside air ductwork.
8. Exhaust ductwork.
9. HVAC water and steam piping.
10. Steam condensate piping.
11. Fire protection piping.
12. Natural gas piping.
13. Domestic water (cold and hot).
15. Electrical conduit.

C. The light fixture grid layout as indicated on the drawings must be maintained. This Contractor shall refer to all light fixture plans and details indicated on the drawings and shall coordinate the location of dampers, supply grilles, return air grilles, sprinkler heads, etc. with the location of the light fixtures to assure proper access to all items in a manner acceptable to the Owner’s Representative.

3.5 CONNECTIONS FOR OTHERS

A. After the equipment is set in place, this Contractor shall make all final connections and shall provide all required pipe, fittings, valves, traps, connectors, etc.

B. Provide all air gap fittings required, using materials hereinbefore specified. In each water line serving an item of equipment or piece of machinery, provide a shutoff valve.

C. Provide all transition pieces, etc. required for a complete installation of equipment provided by others.

3.6 INSTALLATION METHODS

A. Where to Conceal: All pipes and conduits shall be concealed in pipe chases, walls, furred spaces, below suspended floors, or above the ceilings of the building unless otherwise indicated.

B. Where to Expose: In mechanical rooms, janitor’s closets tight against pan soffits in exposed Tee structures, or storage spaces, but only where necessary, piping and conduit may be run exposed. All exposed piping and conduit shall be run in the neatest, most inconspicuous manner, and parallel or perpendicular to the building lines. All exposed piping to be coordinated with Architect.

C. Support: All piping and conduit shall be adequately and properly supported from the building structure by means of hanger rods or clamps to walls as herein specified.

D. Maintaining Clearance: Where limited space is available above the ceilings and below concrete beams or other deep projections, pipe and conduit shall be sleeved through the projection where it crosses, rather than hung below them, in a manner to provide maximum above-floor clearance. Sleeves shall be as herein specified. Approval shall be obtained from the Owner’s Representative for each penetration.

E. All pipe, conduits, etc. shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All pipes, and conduits run exposed in machinery and equipment rooms shall be installed parallel to the
building lines, except that they shall be sloped to obtain the proper pitch. Piping run in furred ceilings, etc. shall be similarly installed, except as otherwise shown. Conduits in furred ceilings and in other concealed spaces may be run at angles to the construction but shall be neatly grouped and racked indicating good workmanship. All conduit and pipe openings shall be kept closed until the systems are closed with final connections.

F. Special Requirements:
1. There shall be no pipe joints nearer than 12 inches to a wall, ceiling, or floor penetration unless pipe joint is a welded or mechanically-coupled-type joint.
2. The Contractor shall study all construction documents and carefully lay out all work in advance of fabrication and erection in order to meet the requirements of the extremely limited spaces. Where conflicts occur the Contractor shall meet with all involved trades and the Owner's Representative and resolve the conflict prior to erection of any work in the area involved.
3. Prior to the installation of any ceiling material, gypsum, plaster, or acoustical board, the Contractor shall notify the Owner's Representative so that arrangements can be made for an inspection of the above-ceiling area about to be "sealed off." The Contractor shall give as much advance notice as possible up to five (5) working days, but in no case less than three (3) working days.
4. The purpose of this inspection is to verify the completeness and quality of the installation of the air conditioning systems, the plumbing systems, and any other special above-ceiling systems such as pneumatic tube. The ceiling supports (tee bar or lath) should be in place so that access panel and light fixture locations are identifiable and so that clearances and access provisions may be evaluated.
5. No ceiling material shall be installed until the deficiencies listed from this inspection have been corrected to the satisfaction of the Owner's Representative.

3.7 TESTS AND INSPECTIONS

A. General: The Contractor shall make all tests deemed necessary by the inspection departments of the authority having jurisdiction, Board of Underwriters, etc. He shall provide all equipment, materials, and labor for making such tests. Fuel and electrical energy for system operational tests following beneficial occupancy by the Owner will be paid for by the Owner.

B. Other: Additional tests specified hereinafter under the various specifications sections shall be made.

C. Notification: The Owner's Representative shall be notified at his office 36 hours prior to each test and other specifications requirements requiring action on the part of the Owner, Architect, Engineer, and/or Owner's Representative.

D. Test Logs: All tests which the Contractor conducts shall have pertinent data logged by the Contractor at the time of testing. Data shall include date, time, personnel, description and extent of system tested, test conditions, test results, specified results, and any other
pertinent data. Data shall be delivered to the Owner's Representative as specified under “Requirements for Final Acceptance.

E. Inspections: In general, an inspection by the Owner's Representative shall be required prior to closing up any work and prior to beneficial occupancy or final project completion. The closing up of work includes, but is not limited to, pipe and conduit installations prior to backfilling; mechanical, electrical, and fire protection work prior to placement of concrete; or closing up walls and overhead mechanical, electrical, and fire protection work prior to installation of the ceiling.

3.8 DISCHARGE OF WASTES FROM CONSTRUCTION SITE

A. The Contractor shall comply with all applicable provisions of local, state, and federal laws regarding the discharge of wastes into sewer and waterways. Special caution shall be exercised to prevent the discharge of wastes which contain oil, tar, asphalt, roofing compound, kerosene, gasoline, paint, mud, cement, lime, or other materials which would degrade the water quality of the receiving water course. The Contractor shall construct and maintain oil interceptors, settling basins, acid neutralization tanks, and/or other effective pollution countermeasures, as required by the Texas Water Quality Board.

END OF SECTION
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. Piping materials and installation instructions.
   2. Mechanical sleeve seals.
   3. Sleeves.
   4. Escutcheons.
   5. Grout.
   6. Fire-suppression equipment and piping demolition.
   7. Equipment installation requirements common to equipment sections.
   8. Painting and finishing.
   9. Concrete bases.
   10. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:
1. CPVC: Chlorinated polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:
   1. EPDM: Ethylene-propylene-diene terpolymer rubber.
   2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Mechanical sleeve seals.
   2. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Fire Suppression Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Fire Suppression Sections for joining materials not listed below.

2.4 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
   1. Manufacturers:
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.
      c. Metraflex Co.
      d. Pipeline Seal and Insulator, Inc.
   2. Sealing Elements: EPDM 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. Include two for each sealing element.
   4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.
2.5 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
   1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.


G. Molded PE: Reusable, PE, tapered-cup shaped and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.
   1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
   1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.7 GROUT
A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 FIRE-SUPPRESSION DEMOLITION

A. Refer to Specification Section "Cutting and Patching" and Specification Section "Selective Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove fire-suppression systems, equipment, and components indicated to be removed.
   1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
   3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
   5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
   1. New Piping:
      a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
      b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
      c. Insulated Piping: One-piece, stamped-steel type with spring clips.
      d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
      e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
      f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
      g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type and set screw.
      h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
      i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed.
      j. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
      k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw.
      l. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.
N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
   a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
   b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
   c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Specification Section "Sheet Metal Flashing and Trim" for flashing.
      1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Specification Section "Joint Sealants" for materials and installation.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve.
Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Specification Section "Penetration Firestopping" for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PAINTING

A. Painting of fire-suppression systems, equipment, and components is specified in Specification Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. Sprinkler heads are not to be painted.

3.4 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Specification Section "Metal Fabrications" for structural steel.
B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.6 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor fire-suppression materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.7 GROUTING

A. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION
SECTION 21 13 13
FIRE SUPPRESSION PIPING WET-PIPE SPRINKLER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes the following fire-suppression piping system(s) inside the building. See other specification sections for additional systems requirements.
   1. Wet-pipe sprinkler systems.
B. Related Sections include the following:
   1. Specification Section “Fire Alarm” for alarm devices not specified in this Section.
   3. Specification Section “Special Conditions for all Fire Suppression Work.”
C. Scope of Work: Install a complete wet-pipe fire sprinkler system Per NFPA.

1.3 DEFINITIONS
A. High-Pressure Piping System: Fire-suppression piping system designed to operate at working pressure high than standard 175 psig.
B. Underground Service-Entrance Piping: Underground service piping below the building.

1.4 SYSTEM DESCRIPTION
A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS
B. Fire-suppression sprinkler system design shall be approved for authorities having jurisdiction.
   1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping; valves, and backflow preventers.
   2. Sprinkler Occupancy Hazard Classifications:
      a. Building Service Areas: Ordinary Hazard, Group 1.
      b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
      c. General Storage Areas: Ordinary Hazard, Group 1.
      d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
      e. Office and Public Areas: Light Hazard.
   3. Minimum Density for Automatic-Sprinkler Piping Design:
      a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq.ft. (6.3 mL/s over 139-sq. m) area.
      b. Ordinary-hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. (9.5 mL/s over 139-sq. m) area.
   4. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:
      a. Light-Hazard Occupancies: 100 gpm (6.3 L/s) for 30 minutes.
      b. Ordinary-Hazard Occupancies: 250 gpm (15.75 L/s) for 60 to 90 minutes.

1.6 SUBMITTALS
   A. Product Data: For the following: All products must be UL approved.
      1. Piping materials, including dielectric fittings and sprinkler specialty fittings.
      2. Pipe hangers and supports.
      3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
      4. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
      5. Hose connections, including size, type, and finish.
      6. Hose stations, including size, type, and finish of hose connections; type and length of fire hoses; finish of fire hose couplings; type, material, and finish of nozzles; and finish of rack.
      7. Alarm devices, including electrical data.
   B. Shop Drawings: Diagram power, signal, and control wiring.
   C. Fire-hydrant flow test report.
   D. Approved Sprinkler Piping Drawings: Working Plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations.
   E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include “Contractor’s Material and Test Certificate for Aboveground Piping” and “contractor’s Material and Test Certificate for Underground Piping.”
F. Welding certificates.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Installer’s responsibilities include designing, fabricating, and installing fire-suppression systems and providing design services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test. All work is to be executed by an RME employed by the installing contractor.

B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

C. Steel Pipe Welding: Quality processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, “Welding and Brazing Qualifications.”
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:

1.8 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.
1.10 STORAGE OF MATERIALS

A. Store all piping on site in a clean, dry, clear area on the jobsite – covered and protected from the elements. Pipe is not to be directly on the ground, support pipe off of ground by wood blocking or other material. All pipe ends are to be capped and protected from the elements until piping is ready for installation. Any piping not covered or protected will be required to be removed from the jobsite and replaced at no cost to the owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide products from one of the following manufacturers:
   1. Viking Corp.
   3. VGS by Viking
   4. Flex head
   5. ARGCO (Allied Rubber & Gasket Co.)
   6. Tyco
   7. Victaulic Co. of America
   8. Ward Manufacturing
   9. Milwaukee Valve Company
   10. Sigma Valve Co.
   11. Mueller Company
   12. NIBCO
   13. Reliable Automatic Sprinkler Co., Inc.
   15. Guardian Fire Equipment Incorporated

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell end and plain end.
   1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern.
   2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron gland, rubber gasket, and steel bolts and nuts.

B. Push-on-Joint, Ductile-Iron Fittings: AWWA C151, with push-on-joint bell end and plain end.
   1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern.
   2. Gaskets: AWWA C111, rubber.

C. Corrosion-Protective Encasement for Piping
1. Encasement for Underground Metal Piping: ASTM A674 or AWWA C105, PE film, 0.008-inch minimum thickness, tube or sheet.

2.3 STEEL PIPE AND FITTINGS

A. All steel pipe to be threaded end, grooved end or weld-thread/grooved-end only. Hex/reducing bushing, locking lug or saddle fittings are NOT acceptable.

B. Threaded-End, Standard-Weight Schedule 40 Steel Pipe: ASTM 135 and with factory- or field-formed threaded ends.

C. Grooved-End, Standard-Weight Schedule 10 Steel Pipe: ASTM A 135 and with factory- or field-formed, square-cut- or roll-grooved ends.
   1. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
   2. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe and fitting grooves, pre-lubricated rubber gasket listed for use with housing, and steel bolts and nuts.

   1. UL/FM approved.

2.4 SPRINKLER SPECIALTY FITTINGS

A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig minimum working-pressure rating and made of materials compatible with piping.

B. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded inlet and outlet, test valve and orifice and sight glass.

C. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.

D. Sprinkler Inspector’s Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.

E. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet and seals.

F. Flexible Drops: FMG approved Viking or equal.
2.5 LISTED FIRE-PROTECTION VALVES

A. Valves shall be UL listed or FMG approved, with 175-psig minimum pressure rating.

B. Ball Valves: Comply with UL 1091, except with ball instead of disc.
   1. NPS 1-1/2 and Smaller: Bronze body with threaded ends.
   2. NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
   3. NPS 3: Ductile-iron body with grooved ends.

C. Butterfly Valves: UL 1091.
   1. NPS 2 and Smaller: Bronze body with threaded ends.
   2. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.

D. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.

E. Gate Valves: UL 262, OS&Y type.
   1. NPS 2 and Smaller: Bronze body with threaded ends.
   2. NPS 2-1/2 and Larger: Cast-iron body with flanged ends.

2.6 UNLISTED GENERAL-DUTY VALVES

A. Ball Valves NPS 2 and Smaller: 2-piece copper-alloy body with stainless steel trim, 600-psig minimum CWP rating, blowout-proof stem, and threaded ends.

B. Check Valves NPS 2 and Smaller: Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.

C. Gate Valves NPS 2 and Smaller: Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.

D. Globe Valves NPS 2 and Smaller: Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.7 SPECIALTY VALVES

A. Sprinkler System Control Valves: UL listed or FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating.
   1. Alarm Check Valves: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber and fill-line attachment with strainer.
      a. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
      b. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
B. Automatic Drain Valves: UL 1726, NPS 3/4, ball-check device with threaded ends.

2.8 SPRINKLERS

A. Sprinklers shall be UL listed or FMG approved, Viking or equal with 175-psig minimum pressure rating.

B. Automatic Sprinklers: With heat-responsive element complying with the following:
   1. UL 199, for nonresidential applications.
   2. UL 1767, for early-suppression, fast-response applications.

C. Sprinkler Types and Categories: Nominal 1/2-inch orifice for “Ordinary” temperature classification rating, unless otherwise indicated or required by application.
      a. Orifice: 1/2 inch with discharge coefficient K between 5.3 and 5.8.
      b. Orifice: 17/32 inch with discharge coefficient K between 7.4 and 8.2

D. Sprinkler types, features and options as follows: Viking or equal
   1. Concealed ceiling sprinklers, including cover plate.
   2. Extended-coverage sprinklers.
   3. Flow-control sprinklers, with automatic open and shutoff feature.
   4. Flush ceiling sprinklers, including escutcheon.
   5. High-pressure sprinklers.
   6. Institution sprinklers, made with a small, breakaway projection.
   7. Open sprinklers.
   8. Pendent sprinklers.
   9. Pendent, dry-type sprinklers.
   10. Quick-response sprinklers.
   11. Recessed sprinklers, including escutcheon.
   12. Sidewall sprinklers.
   13. Sidewall, dry-type sprinklers.

E. Sprinkler Finishes: Chrome plated, bronze, and painted.

F. Special Coatings: Wax, lead, ENT and corrosion-resistant paint.

G. Sprinkler Escutcheons: Materials, types and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
   1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
   2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

H. Sprinkler Guards: Viking or equal Wire-cage type, including fastening device for attaching to sprinkler.
2.9 HOSE CONNECTIONS

A. Description: UL 668, brass or bronze, 300-psig minimum pressure rating, hose valve for connecting fire hose. Include angle or gate pattern design, as indicated; female NPS inlet and male hose outlet; and lugged cap, gasket, and chain. Include NPS 1-1/2 or NPS 2-1/2 as indicated, and hose valve threaded according to NFPA 1963 and matching local fire department threads.
   2. Finish: Rough metal or chrome-plated, as indicated.

2.10 FIRE DEPARTMENT CONNECTIONS

A. Exposed, Freestanding-Type, Fire Department Connections: UL 405, 175-psig minimum pressure rating; with corrosion-resistant-metal body, brass inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, and bottom outlet with pipe threads. Include brass lugged caps, gaskets, and brass chains; brass lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch-high, brass sleeve; and round, floor, brass escutcheon plate with marking “AUTO SPKR & STANDPIPE.”
   1. Finish Including Sleeve: Polished brass.

B. Wall-Type, Fire Department Connection: UL 405, 175-psig minimum pressure rating, with corrosion-resistant-metal body with brass inlets, brass wall escutcheon plate, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking similar to “AUTO SPKR & STANDPIPE.”
   1. Type: Flush, with multiple inlets and square or rectangular escutcheon plate.
   2. Type: Exposed, projecting, with two inlets and round escutcheon plate.

2.11 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm: UL 753, mechanical-operation type with pelton-wheel operator with shaft length, bearings, and sleeve to suit wall construction and 10-inch diameter, cast-aluminum alarm gong with red-enamel factory finish. Include NPS 3/4 inlet and NPS 1 drain connections.

C. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
D. Pressure Switch: UL 753, electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.

E. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

2.12 PRESSURE GAGES

A. Description: UL 393, 3-1/2 to 4-1/2-inch diameter, dial pressure gage with range of 0 to 250 psig minimum.
   1. Water System Piping: Include caption “WATER” or “AIR/WATER” on dial face.
   2. Air System Piping: Include retard feature and caption “AIR” or “AIR/WATER” on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in Part 1 “Quality Assurance” Article.

B. Report test results promptly and in writing.

3.2 EXAMINATION

A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.

B. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PIPING APPLICATIONS, GENERAL

A. Shop weld pipe joints welded piping as indicated.

B. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system’s pressure rating may be used in aboveground applications, unless otherwise indicated.
C. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight Schedule 40 steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.


3.4 SPRINKLER SYSTEM PIPING APPLICATIONS

A. Standard-pressure, Wet-Pipe Sprinkler System, 175-psig Maximum Working Pressure;
   1. All piping NPS 2 and smaller shall be the following: Standard weight Schedule 40 threaded steel pipe, cast or malleable iron threaded fittings.
   2. All piping NPS 2-1/2 and larger shall be the following: Schedule 10 steel pipe, grooved fittings and welded fittings.

B. Water Service Pipe (up to Alarm Riser)
   1. Mechanical-Joint, Ductile Iron and fittings (above ground).

3.5 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Listed Fire-Protection Valves: UL listed and approved for applications where required by NFPA 13.
      a. Shutoff Duty: Use ball, butterfly, or gate valves.
   2. Unlisted General-Duty Valves: For applications where UL-listed and approved valves are not required by NFPA 13.
      a. Shutoff Duty: Use ball, butterfly, or gate valves.

3.6 JOINT CONSTRUCTION

A. Refer to Specification Section “Basic Fire Suppression Materials and Methods” for basic piping joint construction.

B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread nipples shorter than 8 inches with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.

C. Grooved Joints: Assemble joints with listed Viking or equal coupling and gasket, lubricant, and bolts.
   1. Steel Pipe: Square-cut or roll-groove piping. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.

D. Ductile Iron Joints:
1. Locking-lug fittings UL 213, ductile iron body with retainer lugs that require one quarter turn to secure pipe in fitting.

3.7 SERVICE-ENTRANCE PIPING

A. Connect fire-suppression piping to water-service piping of size and in location indicated for service entrance to building. Refer to Specification Section “Water Distribution” for exterior piping.

B. Install shutoff valve, check valve, pressure gage and drain at connection to water service.

3.8 PIPING INSTALLATION

A. Refer to Specification Section “Basic Fire Suppression Materials and Methods” for basic piping installation.

B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
   1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

C. Install underground ductile-iron service-entrance piping according to NFPA 24 and with restrained joints. Encase piping in corrosion-protective encasement.

D. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes. Saddle fittings or saddle couplings are NOT approved.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

F. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.

G. Install “Inspector’s Test Connections” in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler zone control valves, test assemblies and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install drain valves on standpipes.

K. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
L. Install alarm devices in piping systems.

M. Hangers and Supports: Comply with NFPA 13 for hanger materials.
   1. Install sprinkler system piping according to NFPA 13.
   2. All hangers and supports to be galvanized.
   3. All supports to be secured to building structure.
   4. All supports to be listed as a support system (pipe not acceptable as supports).
   5. Pipe Support: All pipes throughout the building, both horizontal and vertical, shall be adequately supported from the construction to line of grade, with proper provision for expansion, contraction, vibration elimination, and anchorage. Vertical pipe shall be supported from floor lines with riser clamps sized to fit the lines and to adequately support their weight. At the bases of lines, where required for proper support, provide anchor base fittings or other approved supports.

N. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

O. Fill wet-pipe sprinkler system piping with water.

3.9 VALVE INSTALLATION

A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.

D. Specialty Valves:
   1. Alarm Check Valves: Install in vertical position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.

3.10 SPRINKLER APPLICATIONS

A. Drawings indicate sprinkler types to be used. Where specific types are not indicated, use the following sprinkler types:
   1. Rooms without Ceilings: Upright sprinklers.
   2. Rooms with Suspended Ceilings: Recessed sprinklers.
5. Spaces Subject to Freezing: Pendent, dry sprinklers; and sidewall, dry sprinklers as indicated.
7. Sprinkler Finishes:
   a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.
   b. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
   c. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.

3.11 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension and at 1/4, 1/2, or 3/4 points of long dimension of acoustical ceiling panels and tiles.

B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

3.12 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install freestanding-type, fire department connection in level surface.
   1. Install protective pipe bollards on three sides of each fire department connection. Refer to Specification Section “Metal Fabrications” for pipe bollards.

B. Install wall-type, Fire Department connection in vertical wall (reference details).

C. Install ball drip valve at each check valve for fire department connection.

3.13 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping. Refer to Specification Section “Plumbing Specialties” for backflow preventers.

D. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.

E. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.
F. Electrical Connections: Power wiring is specified in Electrical Specifications.

G. Connect alarm devices to fire alarm.

H. Ground equipment according to Specification Section “Grounding and Bonding.”

I. Connect wiring according to Specification Section “Conductors and Cables.”

J. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. If manufacturer’s torque valves are not indicated, use those specified in UL 486A and UL 486B.

3.14 LABELING AND IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. All pipe shall be clearly identified in mechanical rooms and congested areas.

3.15 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   3. Energize circuits to electrical equipment and devices.
   4. Start and run excess-pressure pumps.
   5. Flush, test, and inspect sprinkler systems according to NFPA 13, “Systems Acceptance” Chapter.
   6. Coordinate with fire alarm tests. Operate as required.
   7. Verify that equipment hose threads are same as local fire department equipment.

B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.16 CLEANING AND PROTECTION

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint or corrosion other than factory finish.

C. Protect sprinklers from damage until Substantial Completion.

D. All material to be protected from weather and shall not be installed rusted or weathered.
3.17 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain specialty valves. Refer to Specification Section “Demonstration and Testing.”

END OF SECTION
SECTION 22 00 06

PLUMBING DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Demolition and removal of selected portions of building or structure.
   2. Demolition and removal of selected site elements.
   3. Salvage of existing items to be reused or recycled.

1.2 DEFINITIONS

A. Remove or Demolish: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner cleaned, packaged, and ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

   1. Coordinate with Owner's representative, who will establish special procedures for removal and salvage.

1.4 SUBMITTALS

A. Schedule of Selective Demolition Activities: Indicate the following:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
   2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services (including but not limited to: Gas, Water, Fire Suppression, Chilled Water, Hot Water, Air Conditioning, etc).
4. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
5. Means of protection for items to remain and items in path of waste removal from building.

B. Inventory: After selective demolition is complete, submit a list of items that have been salvaged.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI A10.6 and NFPA 241.

C. Pre-demolition Conference: Conduct conference at Project site to comply with requirements in Section “Project Management and Coordination.” Review methods and procedures related to selective demolition including, but not limited to, the following:
1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 PROJECT CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is unknown whether hazardous materials will be encountered in the Work.
1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.
E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.

B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
   1. Arrange to shut off indicated utilities with utility companies.
   2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
   3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
   3. Maintain adequate ventilation when using cutting torches.
   4. Dispose of demolished items and materials promptly.

B. Removed and Salvaged Items:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area designated by Owner.
   5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:
   1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
   2. Pack or crate items after cleaning and repairing. Identify contents of containers.
   3. Protect items from damage during transport and storage.
   4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

E. Contractor shall terminate demolished pipe and/or ductwork. System shall be capped and insulated per new work specification.
F. Contractor shall remove any abandoned piping and/or ductwork in area of construction during the demolition process.

G. Unforeseen Conditions
   1. Any unforeseen utilities found during construction that directly affect any trade must be brought to the engineer’s attention via RFI.
   2. All existing conditions must be clearly annotated on the As-Built drawings.

H. Repair any walls, floors or roofs that piping, ducts or equipment have been removed from (or through). Patch with similar materials to match finish and color (paint to match). If paint cannot be matched, repaint entire wall or surface.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Demolition and removal of selected portions of building or structure.
   2. Demolition and removal of selected site elements.
   3. Salvage of existing items to be reused or recycled.

1.2 DEFINITIONS

A. Remove or Demolish: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner cleaned, packaged, and ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.
   1. Coordinate with Owner's representative, who will establish special procedures for removal and salvage.

1.4 SUBMITTALS

A. Schedule of Selective Demolition Activities: Indicate the following:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
   2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services (including but not limited to: Gas, Water, Fire Suppression, Chilled Water, Hot Water, Air Conditioning, etc).
4. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
5. Means of protection for items to remain and items in path of waste removal from building.

B. Inventory: After selective demolition is complete, submit a list of items that have been salvaged.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI A10.6 and NFPA 241.

C. Pre-demolition Conference: Conduct conference at Project site to comply with requirements in Section “Project Management and Coordination.” Review methods and procedures related to selective demolition including, but not limited to, the following:
   1. Inspect and discuss condition of construction to be selectively demolished.
   2. Review structural load limitations of existing structure.
   3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
   5. Review areas where existing construction is to remain and requires protection.

1.6 PROJECT CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is unknown whether hazardous materials will be encountered in the Work.
   1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.
E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.

B. Service/ Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
   1. Arrange to shut off indicated utilities with utility companies.
   2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
   3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
   3. Maintain adequate ventilation when using cutting torches.
   4. Dispose of demolished items and materials promptly.

B. Removed and Salvaged Items:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area designated by Owner.
   5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:
   1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
   2. Pack or crate items after cleaning and repairing. Identify contents of containers.
   3. Protect items from damage during transport and storage.
   4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

E. Contractor shall terminate demolished pipe and/or ductwork. System shall be capped and insulated per new work specification.
F. Contractor shall remove any abandoned piping and/or ductwork in area of construction during the demolition process.

G. Unforeseen Conditions
   1. Any unforeseen utilities found during construction that directly affect any trade must be brought to the engineer’s attention via RFI.
   2. All existing conditions must be clearly annotated on the As-Built drawings.

H. Repair any walls, floors or roofs that piping, ducts or equipment have been removed from (or through). Patch with similar materials to match finish and color (paint to match). If paint cannot be matched, repaint entire wall or surface.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This section covers the general provisions of the mechanical specifications applicable to the following systems:
   1. Heating, air conditioning, and ventilation.

B. The use of the word mechanical in the body of the various specifications sections shall be interpreted to include all the aspects of all of the systems referenced in Mechanical Specifications.

1.2 DRAWINGS

A. These specifications are accompanied by drawings of the building and details of the installations showing the locations of equipment, piping, ductwork, etc. The drawings and these specifications are complementary to each other; requirements described in one or the other shall be considered binding as if described in both.

B. If any departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Owner’s Representative for approval. No departures shall be made without prior written approval by the Owner’s Representative.

C. There are intricacies of construction which are impractical to specify or indicate in detail; means and methods for performing such work shall adhere to commonly accepted industry standards.

D. It is the Contractor’s responsibility to properly use all information found on the Architectural, Structural, Mechanical, and Electrical drawings and applicable shop drawings where such information affects his work.

E. For new buildings, all final dimensions shall be scaled from the Architectural drawings, unless otherwise noted. For work associated with existing buildings (renovations and additions), all final dimensions shall be field verified.

1.3 CONSTRUCTION REQUIREMENTS

A. The architectural, civil, structural, electrical, plumbing, fire protection and mechanical drawings, and specifications are all part of the Contract Documents. In many instances there are details described on another trade’s drawings that are not necessarily included or referenced in the mechanical drawings. It is the Contractor's responsibility to review in
detail all parts of the Contract Documents prior to submitting a bid. Failure to comply
with this requirement shall not relieve the Contractor of responsibility or be used as cause
for additional compensation because architectural, structural, or electrical details were
not included in the mechanical drawings.

B. It is the intent of the Contract Documents to provide complete and fully functional
installation in every respect. Material and/or construction details not specifically
described in the Contract Documents, but commonly considered incidental to the
industry, are required by the Contractor.

C. The Contractor shall be responsible for fitting his material and apparatus into the
building and shall carefully lay out his work at the site to conform to the structural
conditions, to avoid all obstructions, to comply with Codes, to facilitate the work of other
trades, to conform to the details of the installation supplied by the manufacturer of the
equipment to be installed, and thereby to provide an integrated satisfactory operating
installation.

D. The mechanical, electrical and plumbing drawings are schematic in nature and do not
show every connection in detail or every pipe or conduit in its exact location. These
details are subject to the requirements of ordinances and structural and architectural
conditions.

E. The Contractor shall carefully investigate structural and finish conditions and shall
coordinate the separate trades in order to avoid interference between the various phases
of work. Work shall be laid out so that it will be concealed in furred chases and above
suspended ceilings, etc. in finished portions of the building, unless specifically noted to
be exposed. Work shall be installed to avoid compromising structural members;
therefore, inserts to accommodate hangers shall be set before concrete is poured, and
proper openings through floor, walls, beams, etc. shall be provided as hereinafter
specified or as otherwise indicated or required. All work shall be installed parallel or
perpendicular to building lines unless otherwise noted.

F. When the mechanical drawings do not give exact details as to the elevation of pipe or
ducts, physically arrange the systems to fit in the space available at the elevations
intended with the proper grades for the functioning of the system involved. Piping,
exposed conduit, and duct systems are generally intended to be installed true and square
to the building construction, and located as high as possible against the structure in a neat
and workmanlike manner. The plans do not show all required offsets, control lines, pilot
lines, and other location details. Work shall be concealed in all finished areas. Piping
specified to be insulated shall be supported in a manner that will allow the insulation to
be installed without gaps. Insulated piping in concealed areas shall be offset with fittings
as necessary to permit installation of insulation. Bending of pipes or installing pipes in a
strain to insulate will not be permitted.

G. Final placement of serviceable equipment shall be carefully coordinated with all other
trades to ensure sufficient clearance for maintenance according to manufacturer’s
recommendations. Lubricating orifices and adjustable components shall be easily
accessible. Piping, conduit, valve stems, cabling and other building systems shall not interfere with service space.

H. Location of Exposed Devices

1. All exposed devices (grills, registers, diffusers, sprinkler heads, medical gas outlets, plumbing rough-ins, lights, outlets, communication devices, etcetera) shall be referenced to fixed data points that are coordinated with all trades; shall be located to present symmetrical arrangements with respect to the fixed data point; and shall facilitate the proper arrangements of acoustical ceiling tiles. Fixed data points shall include such features as wall and ceiling lines, soffits, balanced border widths, masonry joints, etc. Devices located in acoustical ceiling tiles shall occur symmetrically in tile joints or in the centers of whole tiles. The final determination of the exact location of each outlet and the arrangements to be followed shall be acceptable to the Owner's Representative.

2. The drawings schematically indicate locations of the exposed devices. Final locations shall be determined by carefully coordinating the drawings pertaining to each trade. Where conflicts are identified, Owner's Representative shall determine final location. The Owner reserves the right to make any reasonable change in location of any device before installation, without additional cost.

1.4 QUALIFICATIONS

A. Contractor must have minimum of five years experience installing commercial heating, ventilation and air conditioning systems, plumbing and piping systems similar to those described in these Contract Documents.

B. Contractor must be licensed and hold a current contracting license that has been valid for a minimum of five years in the State of Texas.

C. Contractor must be able to bond work for payment and performance of work being bid. Contractor's bonding agency shall have a Best's insurance rating of A or A+.

1.5 MATERIAL AND EQUIPMENT REQUIREMENTS

A. Manufacturer's Instructions: The manufacturer's published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufacturer materials or equipment, unless otherwise indicated. The Contractor shall promptly notify the Owner's Representative in writing of any conflict between the requirements of the Contract Documents and the manufacturer's direction and shall obtain the clarification of the Owner's Representative before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or such clarification by the Owner's Representative, he shall bear all costs arising in connection with the correction of the deficiencies.
B. Storage at Site: The Contractor shall not receive material or equipment at the jobsite until there is suitable space provided to properly protect equipment from rust, drip, humidity, and dust damage and from surrounding work.

C. Capacities shall be not less than those indicated and shall be such that no component or system becomes inoperative or is damaged because of startup or other overload conditions.

D. Conformance to Agency Requirements: Where materials or equipment are specified to be approved, listed, tested, or labeled by the Underwriters Laboratories, Inc., ETL listed or constructed and/or tested in accordance with the standards of the American Society of Mechanical Engineers or the Air Moving and Conditioning Association, the Contractor shall submit proof that the items furnished under this section of the specifications conform to such requirements. The label of the Underwriters Laboratories, Inc. or ETL applied to the item will be acceptable as sufficient evidence that the items conform to such requirements. The ASME stamp or the AMCA label will be acceptable as sufficient evidence that the items conform to the respective requirements.

E. Nameplates: Each major component of equipment shall have the manufacturer’s name, address, and model-identification number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Inspection.

F. Prevention of Rust: Standard factory finish will be acceptable on equipment specified by model number otherwise surfaces of ferrous metal shall be given a rust-inhibiting coating. The treatment shall withstand 200 hours in salt-spray fog test, in accordance with Method 6061 of Federal Standard No. 141. Immediately after completion of the test, the specimen shall show no signs of wrinkling or cracking and no signs of rust creepage beyond 1/8 inch on either side of the scratch mark. Where rust inhibitor coating is specified hereinafter, any treatment that will pass the above test is acceptable unless a specific coating is specified, except that coal tar or asphalt-type coatings will not be acceptable unless so stated for a specific item. Where steel is specified to be hot-dip galvanized, mill-galvanized sheet steel may be used provided all raw edges are painted with a zinc-pigmented paint conforming to Military Specification MIL-P-26915.

G. Protection from Moving Parts: Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts located so that any person can come in close proximity thereto, shall be fully enclosed or properly guarded.

H. Drive Guards: For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears, and other moving parts regardless of height above the floor. Drive guards may be excluded where motors and drives are inside factory-fabricated air handling units casings. Guards shall be constructed of sheet steel, cast iron, expanded metal, or wire mesh rigidly secured so as to be removable without disassembling pipe duct or electrical connection to equipment. Provide a 1-inch diameter hole in each drive guard at each shaft center to allow access for speed measurement.
I. Verifications of Dimensions: The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, to verify all dimensions in the field, and to advise the Owner’s Representative of any discrepancy before performing any work. Adjustments to the work required in order to facilitate a coordinated installation shall be made at no additional cost to the Owner, Architect, or Engineer.

J. Standard Products: Materials and equipment to be provided shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications, and shall essentially duplicate materials and equipment that have been in satisfactory use at least two years.

K. Spare Parts Data: As soon as practicable after approval of materials and equipment and, if possible, not later than four months prior to the date of beneficial occupancy, the Contractor shall furnish spare parts data for each different item of equipment listed. The data shall include a complete list of parts and supplies with current unit prices and sources of supply, a list of parts and supplies that are either normally furnished at no extra cost with the purchase of the equipment or specified hereinafter to be furnished as part of the Contract, and a list of additional items recommended by the manufacturer to assure efficient operation for a period of 120 days at the particular installation. The foregoing shall not relieve the Contractor of any responsibilities under the warranty specified.

1.6 INSPECTION OF THE SITE

A. The Contractor shall visit the site, verifying all existing items indicated on drawings and/or specified, and familiarize himself with the existing work conditions, hazards, grades, actual formations, soil conditions, structures, utilities, equipment, systems, facilities, and local requirements. The submission of bids shall be deemed evidence of such visits. All proposals shall take these existing conditions into consideration, and the lack of specific information shall not relieve the Contractor of any responsibility.

1.7 UTILITY LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work have been obtained from substantially reliable sources and are offered separately from the Contract Documents, as a general guide only, without guarantee as to accuracy. Examine the site, the locations, and availability of all utilities and services required for their relation to the work. Verify the location of all existing site utilities with each responsible utility company or applicable party. The Contractor shall repair all damage to existing utilities, whether indicated on the drawings or not, at his sole expense.

1.8 PERMITS, UTILITY CONNECTIONS, AND INSPECTIONS
A. Permitting Fees: Contractor shall pay for all fees associated with permits required by municipal authorities having jurisdiction.

B. Tapping and Impact Fees: Contractor shall pay for all fees associated with tapping into municipal utility mains, including sanitary sewer, natural gas and domestic water. Impact fees will be paid for by the Owner.

C. Compliance: The Contractor shall comply in every respect with all requirements of local authorities having jurisdiction, including building inspections, fire marshal, local ordinances and codes, and utility company requirements. In no case does this relieve the Contractor of the responsibility of complying with these specifications and drawings where specified conditions are of a higher quality than the requirements of the above-specified authorities. Where requirements of the specifications and drawings are below the requirements of the above offices having jurisdiction, the Contractor shall make installations in compliance with the requirements of the above authorities.

D. Utilities: The Contractor shall coordinate with the various utility companies involved in this project and shall provide required utility relocations, extensions, modifications, and/or changes (complete in all respects) as described in the Contract Documents. Contractor shall verify the location of all existing utilities with the applicable Utility Company. The Contractor shall be responsible for all damages to existing utilities, whether indicated on drawings or not, and repair all damage to existing utilities as acceptable to the affected Utility Company.

E. Certification: Prior to final acceptance, the Contractor shall furnish a certificate of acceptance from the inspection departments having jurisdiction over the work for any and all work installed under this Contract. Any additional labor costs incurred as a result of a substitution shall be the Contractor's responsibility.

1.9 EXISTING FACILITIES

A. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection, and in-service maintenance of all plumbing, heating, air conditioning, and ventilating services for the new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work.

B. The Contractor shall provide temporary or new services to all existing facilities as required to maintain their proper operation when normal services are disrupted as a result of the work being performed under this project.

C. Where existing construction is removed to provide working and extension access to existing utilities, Contractor shall remove doors, piping, conduit, outlet boxes, wiring,
light fixtures, air conditioning ductwork and equipment, etc. to provide this access and shall reinstall same upon completion of work in the areas affected.

D. Where partitions, walls, floors, or ceilings of existing construction are indicated to be removed, all Contractors shall remove and reinstall in locations approved by the Architect/Engineer all devices required for the operation of the various systems installed in the existing construction. This is to include but is not limited to temperature controls system devices, electrical switches, relays, fixtures, piping, conduit, etc.

E. Outages of services as required by the new installation will be permitted but only at a time approved by the Owner. The Contractor shall allow the Owner two weeks in order to schedule required outages. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including overtime charges, shall be included in the contract amount.

1.10 DEMOLITION AND RELOCATION

A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination or otherwise disposed of as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

B. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the Contractor’s responsibility and shall be repaired or replaced by the Contractor as approved by the Owner, at no additional cost to the Owner.

D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas
or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as hereinbefore specified.

1.11 SUBSTITUTION OF MATERIALS AND EQUIPMENT

A. No substitution of materials or equipment herein specified or called for on the drawings will be permitted, except by written permission of the Owner's Representative. Where several makes of equipment or material are mentioned, any item named may be bid upon provided it meets space, capacity specifications, and other requirements.

1.12 SUBMITTALS

A. Submittals for Review:
   1. As soon as practical or within 30 days after the date of contract award or notice to proceed, and before purchasing or starting installation of any materials or equipment, the Contractor shall submit for review sufficient material and equipment data to indicate that all requirements of the specifications have been met and samples shall be furnished when requested. All manufacturer's data used as part of the submittal shall have all non-applicable features crossed out or deleted in a manner that will clearly indicate exactly what is to be furnished.
   2. Four (4) copies of the submittal list and detailed submittals (for the Owner's and A/E's use) shall be submitted to the Owner's Representative. The Contractor is requested to include a minimum of three (3) additional copies for insertion in the project's Owner's Manuals at the completion of the project, and the number of additional copies the Contractor requires for his and his subcontractor's use during the project's construction. The detailed submittals shall be accompanied by the same number of sets of pictorial and descriptive data derived from the manufacturer's catalogs and sales literature, or incorporated in the shop drawings. The Contractor may provide a detailed submittal on any item even though not required by the Owner's Representative.

B. Format
   1. Submittals shall be in pdf format. The first page shall have a cover sheet inserted with the title “MECHANICAL SUBMITTALS” centered in large print. Below the title shall be printed the name of the project, the date, the project location, the name and address of the contractor, the name and address of the subcontractor and the name and address of the engineer(s) in smaller print.
   2. Provide a Table of Contents at the beginning of the binder that summarizes the information being submitted according to specification section.
   3. Submittals shall be tab divided by specification section; all sections identified in the project specifications shall have a tab. When no information is being provided concerning a particular specification section, insert a single dated sheet that explains the circumstances.
   4. Loose-leaf or piecemeal submittals are not acceptable and subject to rejection unless prior approval has been granted by the Engineer.
C. **Content:**

1. The Contractor shall prepare or cause to be prepared shop drawings, product data, materials and equipment lists, diagrams, data, samples, and other submittals as required by the contract documents, hereinafter referred to as “Submittal Data.” The Contractor shall review and approve all submittal data for compliance with the contract documents, manufacturer’s recommendations, adequacy, clearances, code compliance, safety, and coordination with associated work.

2. The Contractor shall submit approved submittal data to the Owner’s Representative for review and comment as to general conformance with the design concept and general compliance with information given in the contract documents. Owner's Representative's review shall not include review of quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with other trades or work, or construction safety and precautions, all of which are the sole responsibility of the Contractor.

3. The Contractor shall clearly and specifically identify and call to the attention of the Owner's Representative any deviation from the contract documents for which Owner acceptance is desired. The responsibility for such a deviation accepted by the Owner shall remain with the Contractor.

4. Timeliness: The burden of timeliness in the complete cycle of submittal data is on the Contractor. The Contractor shall allow a minimum of four (4) weeks' time frame for review of each submission by the Owner's Representative. The Contractor is responsible for allowing sufficient time in the construction schedule to cover the aforementioned cycles of data processing, including time for all re-submission cycles on nonconforming materials, equipment, etc. covered by the data submitted. Construction delays and/or lack of timeliness in the above regard are the responsibility of the Contractor and will not justify any request for scheduled construction time extensions or extra compensation.

5. Work performed in accordance with approved submittal data that is not in accordance with the Contract Documents and did not have the specific acceptance of the Owner's Representative shall be replaced at Contractor's cost.

D. **Re-submittals**

1. Re-submit entire submittal in accordance with afore mentioned format and content requirements. Loose-leaf or piecemeal re-submittals are not acceptable. New and/or revised data for each section shall be prefaced with a colored (yellow, pink, orange, etc) cover sheet that identifies (in a word or two) the materials and/or equipment being re-submitted. Typeset the words “REVISED SUBMITTAL NO. 1 (or 2, 3 as applicable)” centered at the bottom of the cover sheet.

2. Subsequent re-submittals (second and third, if necessary) shall have different colored cover sheets to distinguish between the various re-submittals.

3. Include a cover letter at front of binder that specifically responds to each “REVISE AND RE-SUBMIT COMMENT” or “REJECTED” comment by number. Example responses would include the following:
   a. RESPONSE: “Please see attached re-submittal.”
   b. RESPONSE: “Will be re-submitted at a later date.”
c. RESPONSE: “Requirement for (xxxxxx) was deleted in Addendum No. 2.”
d. RESPONSE: “Exception requested based on Section xx, Paragraph x.x.x.

E. These paragraphs related to Mechanical submittal data supersede any conflicting requirements contained in Division 01 sections.

1.13 CONTRACTOR CERTIFICATION OF SUBMITTAL DATA

A. The Contractor shall provide the following notarized certificate with all submittal data furnished to the Owner's Representative for review and comment.

Project Title:

Description of Submittal Data:

This is to certify that the above-described submittal data has been reviewed and is approved for compliance with the Contract Documents, manufacturer's recommendation, adequacy, clearances, code compliance, safety, and coordination with other trades and/or work except as follows: (list “none” or itemize and explain). In addition, the Contractor shall submit to the Owner's Representative a signed statement from each representative certifying as follows:

“I certify that the materials and/or equipment listed below have been personally inspected by the undersigned authorized manufacturer's representative and is properly installed and operating in accordance with the manufacturer's recommendations and are asbestos free.”

Name and Company

Notary

1.14 ACCEPTANCE OF MATERIALS AND EQUIPMENT

A. All equipment installed on this project shall have local (within 125 miles) representation, local factory-authorized service, and a local stock of repair parts. This requirement is essential and will be strictly reviewed by the Owner's Representative prior to concurrence with the Contractor's approval for all submittals covered by Mechanical sections of this Specification.

B. NOTICE: The Contractor is responsible for providing materials and equipment that conform to the requirements of the project manual in every respect unless a deviation has been "accepted" in writing. Removal of any nonconforming materials and equipment and
the replacement with conforming materials and equipment shall be at the Contractor's sole expense, regardless of when nonconformance was discovered.

C. Approval of materials and equipment shall be based on manufacturer's published data and shall be tentatively subject to the submission of complete shop drawings which comply with the contract documents. Approval is also dependent upon the existence of adequate and acceptable clearances for entry, servicing, and maintenance.

D. Approval of materials and equipment under this provision shall not be construed as authorizing any deviations from the specifications, unless the attention of the Owner's Representative has been directed in writing to the specific deviations. Data submitted shall not contain unrelated information unless all pertinent information is properly identified.

E. Physical Size of Equipment: Space is critical; therefore, equipment of larger sizes than shown, even though of approved manufacturer, will not be acceptable unless it can be demonstrated that ample space exists for proper installation, operation, and maintenance.

1.15 SHOP DRAWINGS

A. As soon as practicable after the award of contract and approval of materials and equipment, but prior to installation, complete and detailed shop drawings of the following shall be submitted for review and comment:
   1. Equipment arrangements.
   2. Duct layouts.
   3. Piping layouts.
   4. Layouts of equipment spaces indicating ductwork and piping larger than 2 inches.
   5. Typical fittings and connections.
   7. Factory-fabricated equipment and materials.
   8. Anchors.
   9. Control.
   10. Interlock.
   11. Sprinkler locations.
   12. Other details as directed by the Owner's Representative. Composite drawings of areas requiring coordination between trades shall be provided and expedited to eliminate conflicts and to ensure maximum cooperation and work progress.

B. Work performed without benefit of reviewed and approved shop drawings will not be recommended for payment by the Engineer until such time as the shop drawings are submitted, reviewed, and approved. Any work performed without the benefit of reviewed and approved shop drawings may require removal, relocation, and/or replacement at the Contractor's sole expense in order to resolve conflicts between the various systems and provide the performance specified.

C. All installation of equipment, fixtures, terminal devices, etc. shall be made in accordance with approved composite shop drawings. The Contractor shall modify installation and
relocate installed work to provide code clearances, service access, and eliminate conflict with other systems.

D. Submit one print of shop drawings for each area, floor, system, etc. The print will be marked with the A/E's comments and returned to the Contractor. Contractor shall revise shop drawings, incorporate revisions in field and submit revised shop drawings at project close out.

1.16 SITE OBSERVATION

A. Site observation by the Architect, Engineer, and/or Owner's Representative is for the express purpose of verifying compliance by the Contractor with the contract documents, and shall not be construed as construction supervision nor indication of approval of the manner or location in which the work is being performed as being a safe practice or place.

1.17 SUPERVISION

A. In addition to the Superintendent required under the conditions of the contract, each subcontractor shall keep a competent superintendent or foreman on the job at all times.

B. It shall be the responsibility of each superintendent to study all plans and familiarize himself with the work to be done by other trades. He shall coordinate his work with other trades and, before material is fabricated or installed, make sure that his work will not cause an interference with another trade. Where interferences are encountered, they shall be resolved at the jobsite by the superintendents involved. Where interferences cannot be resolved without major changes to the plans, the matter shall be referred to the Owner's Representative for comments.

1.18 OPERATION PRIOR TO COMPLETION

A. When any piece of mechanical equipment is operable and it is to the advantage of the Contractor to operate the equipment, he may do so, providing that he properly supervises the operation and has the written permission of the Owner's Representative to do so. The warranty period shall not commence, however, until such time as the equipment is operated for the beneficial use of the Owner or date of substantial completion, whichever occurs first.

B. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, install clean filter media, properly adjust, and complete all deficiency list items before final acceptance by the Owner. The date of acceptance and the start of the warranty may not be the same date.

1.19 MANUFACTURER'S RECOMMENDATIONS
A. The manufacturer's published directions shall be followed in the delivery, storage, protection, installation, piping, and wiring of all equipment and material. The Contractor shall promptly notify the Owner's Representative, in writing, of any conflict between the requirements of the contract documents and the manufacturer's directions, and shall obtain the Owner's Representative's comments before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or applicable comments from the Owner's Representative, he shall bear all costs arising in connection with the correction of such deficiencies.

1.20 CHECKING AND TESTING MATERIALS AND/OR EQUIPMENT

A. Before final acceptance of the work, an authorized representative of the manufacturer of the installed materials and/or equipment shall personally inspect the installation and operation of his materials and/or equipment to determine that it is properly installed and in proper operating order. Testing and checking shall be accomplished during the course of the work where required by work being concealed, and at the completion of the work otherwise. In addition, the Contractor shall submit to the Owner's Representative a signed statement from each representative certifying as follows:

"I certify that the materials and/or equipment listed below have been personally inspected by the undersigned authorized manufacturer's representative and is properly installed and operating in accordance with the manufacturer's recommendations and are asbestos free."

B. Check inspections shall include plumbing, heating, air conditioning, ventilating, mechanical control and electrical equipment, and such other items hereinafter specified or specifically designated by the Owner's Representative.

1.21 OPERATING AND MAINTENANCE INSTRUCTION

A. The Contractor shall prepare for the owner's manual hereinafter specified complete sets of operating and maintenance instructions, system piping, valving, control and interlock diagrams, manuals, parts lists, etc. for each item of equipment. These are to be assembled as hereinafter specified for owner's manual.

B. In addition, the Contractor shall provide the service of a competent engineer or a technician acceptable to the Owner's Representative to instruct a representative of the Owner in the complete and detailed operation of all equipment and systems. These instructions shall be provided for a period of sufficient duration to fully accomplish the desired results. Upon completion of these instructions, a letter of release will be required, acknowledged by the Owner, stating the dates of instruction and personnel to whom instructions were given.

C. Additional diagrams, operating instructions, etc. shall be provided as specified hereinafter in the other sections of these specifications.

1.22 MATERIAL AND EQUIPMENT SCHEDULES
A. Contractor shall refer to both drawings and specification for schedules. Where reference is made to items “scheduled on drawings” or “scheduled in specifications,” same shall include schedules contained in both the drawings and the specifications. The Contractor's attention is directed to the various specification sections and drawings for schedules.

1.23 APPLICABLE CODES AND STANDARDS

A. The installation shall meet the minimum standards prescribed in the latest editions of the following listed codes and standards, which are made a part of these specifications, except as may be hereinafter specifically modified in these specifications and associated drawings.

1. National Fire Protection Association Standards (NFPA):
   - NFPA 10 - Portable Fire Extinguishers
   - NFPA 54 - National Fuel and Gas Code
   - NFPA 70 - National Electrical Code
   - NFPA 90A - Air Conditioning Systems
   - NFPA 255 - Method of Test of Surface Burning Characteristics of Building Materials

   - 15-78 - Safety Code for Mechanical Refrigeration
   - C.2 - 1984 National Electrical Safety Code
   - A117.1 - Handicapped Code

3. American Society of Mechanical Engineers (ASME): Section IV, V, CSD-1

4. Air Conditioning and Refrigeration Institute Standards (ARI): All standards related to refrigeration and air conditioning equipment and piping furnished under these specifications.

5. American Water Works Association (AWWA): All applicable manuals and standards.


7. Air Moving and Conditioning Association (AMCA): All applicable manuals and standards.


10. Occupational Safety and Health ACT (OSHA):
    - National Sanitation Foundation - Standard No. 2

11. American Society of Heating, Refrigeration, and Air conditioning Engineers (ASHRAE):
    - ASHRAE 90.1


13. American Gas Association (AGA)
14. Underwriters Laboratories, Inc. (UL)
15. Manufacturer's Standardization Society of the Valve and Fitting Industry (MSS)
16. Applicable Local and State Building Codes (International Building Codes, as amended):
17. Applicable Local and State Mechanical Code (International Mechanical Code, as amended).

B. All materials and workmanship shall comply with all applicable city, state, and national codes, specifications, and industry standards. All materials shall be listed by the Underwriters Laboratories, Inc. as conforming to its standards and so labeled in every case where such a standard has been established for the particular type of material in question.

C. The contract documents are intended to comply with the aforementioned rules and regulations; however, some discrepancies may occur. Where such discrepancies occur, the Contractor shall immediately notify the Owner's Representative in writing of said discrepancies and apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with said regulations shall be paid for as covered by Division 1 of these contract documents, providing no work or fabrication of materials has been accomplished in a manner of noncompliance. Should the Contractor fabricate and/or install materials and/or workmanship in such a manner that does not comply with the applicable codes, rules, and regulations, the Contractor who performed such work shall bear all costs arising in correcting these deficiencies to comply with said rules and regulations.

1.24 DEFINITIONS

A. Refer to the condition of the contract for Division 1 for additional requirements regarding definitions.

B. Where "as required" or "as necessary" is used in these specifications or on the drawings, it shall mean "that situations exist that are not necessarily described in detail or indicated that may cause the Contractor certain coordination requirements in performing the work described or indicated. These coordination requirements entail the normal coordination activities expected of the Contractor where multiple trades are involved and new or existing construction causes deviations to otherwise simplistic approaches to the work to be performed. The term shall not be interpreted to permit an option on the part of the Contractor to achieve the end result."

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C. Where “and/or” is used in these specifications or on the drawings, it shall mean “that situations exist where either one or both conditions occur or are required and shall not be interpreted to permit an option on the part of the Contractor.

1.25 FINAL INSPECTION

A. Refer to Division 1 for additional requirements for final inspection.

B. It shall be the responsibility of the Contractor to personally conduct a careful inspection, assuring himself that the work on the project is ready for final acceptance and developing his own “punchlists,” before calling upon the Owner’s Representative to make a final inspection. Failure of the Contractor to conduct such inspections and provide the Owner's Representative with a copy of his “punchlists” prior to the final inspection shall be adequate cause for the Owner's Representative to cancel any Contractor-requested final inspection.

C. In order not to delay final acceptance of the work, the Contractor shall conduct his own “final inspections” prior to requesting the Owner's Representative to “final” the project; will have all necessary bonds, guarantees, receipts, affidavits, etc. called for in the various articles of this specification prepared and signed in advance; and together with a letter of transmittal listing each paper included, shall deliver the same to the Owner's Representative at or before the time of said final inspection. The Contractor is cautioned to check over each bond, receipt, etc. before preparing same for submission to see that the terms check with the requirements of the specifications.

D. The final inspection will be made jointly by the Owner's Representative and the Owner.

1.26 REQUIREMENTS FOR FINAL ACCEPTANCE

A. Requirements for final acceptance shall include but not be limited to the Contractor accomplishing the following:

1. Construction: Complete all construction.
2. Deficiency Lists: Correct all deficiencies listed at time of Substantial Completion.
3. Owner's Manual: Submit at least 30 days prior to final acceptance on (1) copy of the owner's manual for the Owner's Representative's review and comments. Following acceptance, prepare three (3) copies of bound and indexed owner's manual, to be delivered at the time of final acceptance, which shall include but not be limited to the following:
   a. System operating instructions.
   b. System control drawings.
   c. System interlock drawings.
   d. System maintenance instructions.
   e. Manufacturers’, suppliers’, and subcontractors’ names, addresses, and telephone numbers, both local representatives and manufacturers’ service headquarters.
   f. Equipment operating and maintenance instructions and parts lists.
g. Manufacturer’s certifications (see Checking and Testing Materials and/or Equipment, this section).
h. Contractor's warranty.
i. Acceptance certificates of authorities having jurisdiction.
j. Log of all tests made during course of work.
k. Owner's acknowledgment of receipt of instruction, enumerating items in owner's manual.
l. List of manufacturers' guarantees executed by the Contractor.
m. Certified performance curves.
n. Balance and performance test reports.
o. Owner's acknowledgment of items of equipment or accessories indicated or specified to be turned over to Owner.

4. Instructions:
a. Verbal, as herein specified.
b. Posted, framed under glass or plastic laminated:
   1) System operating instructions.
   2) System control drawings.
   3) System interlock drawings.

5. Record Drawings: Deliver the specified record drawings to the Owner's Representative.

1.27 RECORD DRAWINGS

A. The Contractor shall maintain a set of contract drawings (black-line prints) at the jobsite on which he shall indicate the installed (as-built) locations of the following:
   1. Equipment
   2. Main lines of piping and ductwork.
   3. Dimensional locations (including depth) of all underground piping, valves and conduits.

B. Drawings shall be used for construction reference and shall not leave the field office of the jobsite.

C. Drawings shall include all addenda, ASI's, Change Orders, and existing conditions and equipment that are not reflected in the original contract drawings.

D. Upon completion of work, the Contractor shall obtain CAD files of the contract drawings from the Owner's Representative and transfer the above as-built information into these files. The as-built files shall be permanently marked “RECORD DRAWINGS” and printed on full-size Mylar sheets. Upon completion, the CAD files shall be transferred to CD in AutoCAD 2007 format. Both the CAD files CD and Mylar drawings shall be submitted to the Owner's Representative as part of the Close-out Submittals.

E. Refer to Division 1 paragraph entitled “Record Documents” for additional requirements.

1.28 ALLOWANCES
A. Refer to Division 1 for allowances.

1.29 ALTERNATE PROPOSALS

A. Alternate proposals are summarized in Division 1 and on the bid proposal form. Refer to all sections of the specifications and the drawings to determine the exact extent and scope of the various alternate proposals as each pertains to the work of the various trades.

1.30 WARRANTY

A. General: All work performed (including equipment and materials furnished) under the various sections of these specifications shall be 100% warranted, for a period of one (1) year from the date of final acceptance thereof, against defective materials, design, and unauthorized substitution. Upon receipt of note of failure of any part of the guaranteed equipment and/or facilities during the guaranty period, the affected part(s) or facilities shall be replaced promptly with new parts, etc. by and at the expense of the Contractor. Further, the Contractor shall properly obtain, execute, and forward any and all manufacturer's warranties on equipment furnished under the Contract. Refer to Division 1 for additional requirements.

B. Extended Period: The Contractor shall provide all extended time warranties available from the manufacturer of the equipment provided as standard at no additional cost. This includes all extended warranties where specified with certain equipment as directed in other sections of this Specification.

PART 2 - PRODUCTS

2.1 MATERIALS AND WORKMANSHIP

A. All materials, unless otherwise specified, shall be current United States manufacture, new, free from all defects, and of the best quality. Foreign goods specifically approved for use by the Owner's Representative prior to bidding may be furnished.

B. Materials and equipment shall be installed in accordance with the manufacturer’s recommendations and the best standard practice for the type of work involved. All work shall be executed by mechanics skilled in their respective trades, and the installations shall present a neat, precise appearance.

C. The responsibility for the furnishing and installation of the proper mechanical equipment and/or material as intended rests entirely upon the Contractor. The Contractor shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.

2.2 FLAME SPREAD AND SMOKE DEVELOPED PROPERTIES OF MATERIALS
A. Duct coverings, duct linings, vapor barrier facings, tapes, adhesives, core materials, insulation, jackets, piping (of any sort), and other materials in concealed locations, including any above-ceiling area, shall have a flame spread rating not over 25 without evidence of continued progressive combustion and a smoke developed rating no higher than 50. Flame spread and smoke developed ratings shall be in accordance with NFPA Standard No. 255.

2.3 BEARINGS

A. All ball bearings shall be of radial and/or thrust type, and enclosed in a dust and moisture-proof housing.

2.4 MOTORS

A. The Contractor shall provide all motors required for equipment supplied under each portion of the work. Motors shall be premium efficiency and be built in accordance with the latest ANSI, IEE, and NEMA standards, shall be fully coordinated with the equipment served, shall be of sizes and electrical characteristics scheduled.

2.5 STARTING EQUIPMENT

A. Each motor shall be provided with proper starting equipment. This equipment, unless hereinafter specified or scheduled to the contrary, shall be provided by the trade furnishing the motor. All motor starting equipment provided by any one trade shall be of the same manufacture unless such starting equipment is an integral part of the equipment on which the motor is mounted.

2.6 LOW VOLTAGE (CONTROLS/ THERMOSTAT) WIRING

A. All low voltage wiring installed by the Mechanical Contractor, Electrical Contractor or Controls Vendor shall be run in a neat and workmen like manner, parallel and perpendicular to building lines on J-Hooks (above ceiling grid only). Plenum rated cable shall be installed above ceilings. All other locations (exposed, Mechanical Rooms, outdoors or above hard lid ceiling) should be installed in conduit.

2.7 SLEEVES, INSERTS, AND FASTENINGS

A. General: Proper openings through floors, walls, roofs, etc. for the passage of piping, ductwork, conduits, etc. shall be provided. All piping and conduit through floors and piping through walls must pass through sleeves except soil pipe installed under concrete slabs-on-fill, and pipe and conduit that is cast-in-place. Sleeves shall be set in new construction before concrete is poured, as cutting holes through any part of the concrete will not be permitted unless acceptable to the Owner's Representative.
B. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   1. Install steel pipe for sleeves smaller than 6 inches in diameter.
   2. Install cast-iron "wall pipes" for sleeves 6 inches in diameter and larger.
   3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

   1. Assemble and install mechanical sleeve seals according to manufacturer’s written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

D. Sleeves: The minimum clearance between horizontal pipe, including insulation where applicable, and sleeve shall be 1/4 inch, except that the minimum clearance shall be 2 inches where piping contacts the ground. Sleeves through floors shall extend 3/4 inch above the floor; sleeves through walls and partitions shall be installed flush with exposed surfaces.

E. Materials: Install sleeves large enough to provide ¼” annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
   1. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS.
   2. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS and larger, penetrating gypsum-board partitions.
   3. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
      a) Seal space outside of sleeve fittings with non-shrink, nonmetallic grout.

F. Inserts: Suitable concrete inserts for pipe, conduit, and equipment hangers shall be set and properly located for all piping, conduit, and equipment to be suspended from concrete construction.

G. Fasteners: Fastening of pipes, conduits, etc. in the building shall be as follows:
   1. To wood members: by wood screws.
   2. To masonry and concrete: by threaded metal inserts, metal expansion screws, or toggle bolts, whichever is appropriate for the particular type of masonry or concrete.
   3. To steel: machine screws or welding (when specifically permitted or directed), or bolts.

NOTE: Under no circumstances will the use of plastic anchors or plastic expansion shields be permitted for any purpose whatsoever.
H. Ratproofing: The open space around all piping, ductwork, etc. passing through the ground floor and/or exterior walls shall be ratproofed in a manner acceptable to the Owner's Representative.

I. Weatherproofing: The annular space between a pipe and its sleeve in exterior walls or through floor to below grade shall be filled with polyurethane foam rods 50% greater in diameter than the space as backing and fill material and made watertight with a permanent elastic polysulfide compound. Seal both surfaces of wall or floor with a fire-resistant sealant.

J. Air Plenums: The space around piping, ductwork, etc. passing through an air plenum shall be made airtight in a manner acceptable to the Owner's Representative. The sealant used must be fire resistant.

2.8 FIRE AND SMOKE PARTITION, WALL, AND/OR FLOOR PENETRATIONS

A. Pipe, ductwork, conduit, etc. shall pass through fire- or smoke-rated floors, partitions, walls, or other barriers within a UL-listed assembly which shall maintain the rating of the applicable wall, floor, partition, or barrier.

B. The Contractor shall review the architectural and structural drawings and determine the location of the fire-rated building elements. Where these elements are penetrated, UL-listed fire-rated penetration assemblies approved by the local authority shall be provided in accordance with the manufacturer's instructions to obtain the required rating.

2.9 METAL BUILDING SYSTEMS/MECHANICAL-ELECTRICAL SUPPORTS

A. Metal building systems are required to be designed by the manufacturer to accommodate and support the mechanical systems indicated on the mechanical drawings and specified in Mechanical specifications.

B. The metal building systems manufacturer is required to provide the following:
   1. Framed openings through the roofs with supports, roof curbs, and flashings for roof-mounted equipment, fans, vents, and air intakes.
   2. Structural support for piping, conduits, and suspended equipment consisting of beam, joists, purlins, and/or blocking above and perpendicular to pipe routes and equipment hangers at intervals not to exceed 8 feet.
   3. Structural support for suspended ceilings, diffusers, grilles, light fixtures including associated raceways and ductwork.

C. The mechanical trade shall:
   1. Provide all routes, weights, installation heights, opening locations, etc. for all equipment, piping, vents, etc. to the metal building system manufacturer and coordinate requirements for structural supports, hangers, attachments, etc. with the metal building systems manufacturer.
   2. Provide all supporting devices (hangers, attachments, brackets, cross beams, etc.) to attach to the metal building structural system.
2.10 FOUNDATIONS / HOUSEKEEPING PADS

A. General: All special foundations and supports required for the proper installation of equipment and pipe shall be provided as hereinafter specified and under the section of the specifications covering the equipment, unless otherwise indicated on the drawings.

B. All mechanical equipment shall receive concrete housekeeping pads unless otherwise noted. Equipment to receive pads are to include (but not limited to): air handlers, fan-coils, condensing units, boilers, water heaters, water softeners, expansion / compression tanks, filter feeders, water treatment equipment, air compressors, fans, pumps (in addition to inertia bases where required), chillers, surge tanks, deareators, etc.

C. Concrete foundations for the support of equipment such as floor-mounted pumps, fans, etc. shall be not less than 5½ inches high and not less than 4 inches larger (in both directions) than supported unit, unless otherwise noted and shall be poured in forms built of new dressed lumber. All corners of the foundations shall be neatly chamfered by means of sheet metal or triangular wood strips nailed to the form. Pads shall not be laid out directly against walls or structures. 2 inches shall be left available for pad form work. Foundation bolts shall be placed in the forms when the concrete is poured, the bolts being correctly located by means of templates. Allow 1 inch below the equipment bases for alignment and grouting (where applicable). Foundations for equipment located on the exterior of the building shall be provided as indicated. Foundations shall be constructed in accordance with approved shop drawings and shall be reinforced with #4 bars at 12 inches on center both ways (minimum).

D. Pipe and Conduit Support: All pipes and conduits throughout the building, both horizontal and vertical, shall be adequately supported from the construction to line of grade, with proper provision for expansion, contraction, vibration elimination, and anchorage. Vertical pipes and conduits shall be supported from floor lines with riser clamps sized to fit the lines and to adequately support their weight. At the bases of lines, where required for proper support, provide anchor base fittings or other approved supports.

2.11 ACCESS DOORS

A. General: Provide access doors for all serviceable mechanical appurtenances (valves, trap primers, shock arresters, volume dampers, fire/smoke dampers, actuators, sensors, etcetera) in inaccessible locations. Such locations include gypsum, brick and CMU ceilings and walls.

B. Location of panels shall be carefully coordinated with other Exposed Devices as described in earlier paragraphs.

C. Manufacturers shall be Inland-Milcor, Bilco, Miami Carey, or approved equal. Unless indicated otherwise, use panels equal to Milcor Style M for masonry and drywall construction, equal to Milcor Style K for plastered masonry walls and ceilings. Stainless steel panels shall be used in ceramic tile or glazed structural tile.
D. Minimum construction features include 14-gage frame and door, continuous hinges, cam-style latch and 10x10" unobstructed opening size.

E. UL labeled when in fire-rated construction, one and one-half hour rating.

F. Access doors located outside, in restrooms or in a moisture-laden environment (dressing area, shower area, lockers, etc.) shall be stainless steel construction.

G. Equipment access doors shall be of sufficient size to remove/replace equipment and provide routine maintenance as necessary, unless otherwise noted. Doors shall be set flush with adjacent finish surfaces. Exterior doors shall be provided with cylinder locks.

H. Access doors into ductwork shall be 14-gauge insulated galvanized steel with 16-gauge galvanized gasketed steel frame and cam-type locks. Ductwork access door shall be a minimum of 12" × 12" in size.

2.12 FLOOR AND CEILING PLATES

A. Except as otherwise noted, provide one-piece chrome-plated brass floor and ceiling plates (or escutcheons) around all pipes, conduits, etc. passing through walls, floors, or ceilings in any spaces, except underfloor and attic spaces. Plates shall be sized to fit snugly against the outside of the pipe or against the outside of insulation on lines which are insulated, and positively secured to such pipe or insulation. Plates will not be required for piping where pipe sleeves extend ¾ of an inch above finish floor and are concealed. Plates shall be one piece.

PART 3 - EXECUTION

3.1 SPACE AND EQUIPMENT ARRANGEMENT

A. The size of mechanical equipment indicated on the drawings is based on the dimensions of a particular manufacturer. While other manufacturers will be acceptable, it is the responsibility of the Contractor to determine whether the equipment he proposes to furnish will fit in the space. Shop drawings shall be prepared when required by the Owner's Representative to indicate a suitable arrangement.

B. All equipment shall be installed in a manner to permit access to all surfaces. All valves, motors, drives, filters, and other accessory items shall be installed in a position to allow removal for service without disassembly of another part.

3.2 LARGE APPARATUS

A. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through stairways, doorways, or shafts shall be brought to the job and placed in the space before the enclosing structure is completed.
Following placement in the space, such apparatus shall be thoroughly, completely protected from damage as hereinafter specified.

3.3 PROTECTION

A. The Contractor shall take such precautions as may be necessary to properly protect all materials and equipment from damage from the time of delivery until the completion of work. This shall include the erection of all required temporary shelters and supports to adequately protect any items stored in the open on the site from the weather, the ground and surrounding work; the cribbing of any items above the floor of the construction; and the covering of items in the uncompleted building with tarpaulins or other protective covering. Failure on the part of the Contractor to comply with the above will be sufficient cause for the rejection of the items in question.

B. The Contractor shall protect existing facilities, the work of others, and the premises from any and all damages that may be made possible by the execution of work.

C. Equipment and materials shall be protected from rust both before and after installation. Any equipment or materials found in a rusty condition at the time of final inspection must be cleaned of rust and repainted as specified elsewhere in these specifications.

3.4 COOPERATION BETWEEN TRADES AND WITH OTHER CONTRACTORS

A. Each trade, subcontractor, and/or Contractor must work in harmony with the various trades, subcontractors, and/or Contractors on the job as may be required to facilitate the progress to the best advantage of the job as a whole. Each trade, subcontractor, and/or Contractor must pursue its work promptly and carefully so as not to delay the general progress of the job. This Contractor shall work in harmony with Contractors working under other contracts on the premises.

B. It shall be the responsibility of each trade to cooperate fully with the other trades on the job to help keep the jobsite in a clean and safe condition. At the end of each day's work, each trade shall properly store all of its tools, equipment, and materials and shall clean its debris from the job. Upon the completion of the job, each trade shall immediately remove all of its tools, equipment, any surplus materials, and all debris caused by its portion of the work.

3.5 PRECEDENCE OF MATERIALS AND COORDINATION OF WORK

A. These specifications and the accompanying drawings are intended to cover systems which will not interfere with the structural design of the building, which will fit into the several available spaces, and which will ensure complete and satisfactory systems. Each subcontractor and/or trade shall be responsible for the proper fitting of his material and apparatus into the building.
B. The work of the various trades shall be performed in the most direct and workmanlike manner without hindering or handicapping the work of other trades. Piping interferences shall be handled by giving precedence to pipe lines which require a stated grade for proper operation. Where space requirements conflict, the following order or precedence shall, in general, be observed:
1. Building lines.
2. Structural members.
3. Light fixtures.
4. Soil and drain piping.
5. Condensate drains.
6. Vent piping.
7. Supply, return, and outside air ductwork.
8. Exhaust ductwork.
9. HVAC water and steam piping.
10. Steam condensate piping.
11. Fire protection piping.
12. Natural gas piping.
13. Domestic water (cold and hot).
15. Electrical conduit.

C. The light fixture grid layout as indicated on the drawings must be maintained. This Contractor shall refer to all light fixture plans and details indicated on the drawings and shall coordinate the location of dampers, supply grilles, return air grilles, sprinkler heads, etc. with the location of the light fixtures to assure proper access to all items in a manner acceptable to the Owner’s Representative.

D. The electrical trades shall locate all junction boxes, pull boxes, conduits, etc. to avoid interference with the diffusers, dampers, grilles, etc. hereinbefore mentioned. The mechanical trades shall furnish to all other trades copies of approved ductwork shop drawings to assist in the coordination of the rough-in and installation of all items of work.

3.6 CONNECTIONS FOR OTHERS

A. This Contractor shall rough-in for and make all water, sewer, electrical, etc. connections to all fixtures, equipment, machinery, etc. provided by others in accordance with detailed roughing-in drawings provided by the equipment suppliers, by actual measurements of the equipment connections, or as detailed.

B. After the equipment is set in place, this Contractor shall make all final connections and shall provide all required pipe, fittings, valves, traps, connectors, etc.

C. Provide all air gap fittings required, using materials hereinbefore specified. In each water line serving an item of equipment or piece of machinery, provide a shutoff valve. On each drain without integral trap provide a suitable trap.
D. All pipe fittings, valves, traps, etc. exposed in finished areas and connected to chrome-plated lines provided by others shall be chrome-plated to match.

E. Provide all sheet metal ducts, transition pieces, etc. required for a complete installation of equipment provided by others.

3.7 INSTALLATION METHODS

A. Where to Conceal: All pipes and conduits shall be concealed in pipe chases, walls, furred spaces, below suspended floors, or above the ceilings of the building unless otherwise indicated.

B. Where to Expose: In mechanical rooms, janitor’s closets tight against pan soffits in exposed Tee structures, or storage spaces, but only where necessary, piping and conduit may be run exposed. All exposed piping and conduit shall be run in the neatest, most inconspicuous manner, and parallel or perpendicular to the building lines.

C. Support: All piping and conduit shall be adequately and properly supported from the building structure by means of hanger rods or clamps to walls as herein specified.

D. Maintaining Clearance: Where limited space is available above the ceilings and below concrete beams or other deep projections, pipe and conduit shall be sleeved through the projection where it crosses, rather than hung below them, in a manner to provide maximum above-floor clearance. Sleeves shall be as herein specified. Approval shall be obtained from the Owner's Representative for each penetration.

E. All pipe, conduits, etc. shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All ducts, pipes, and conduits run exposed in machinery and equipment rooms shall be installed parallel to the building lines, except that they shall be sloped to obtain the proper pitch. Piping and ducts run in furred ceilings, etc. shall be similarly installed, except as otherwise shown. Conduits in furred ceilings and in other concealed spaces may be run at angles to the construction but shall be neatly grouped and racked indicating good workmanship. All conduit and pipe openings shall be kept closed until the systems are closed with final connections.

F. Special Requirements:
   1. There shall be no pipe joints nearer than 12 inches to a wall, ceiling, or floor penetration unless pipe joint is a welded or mechanically-coupled-type joint.
   2. The Contractor shall study all construction documents and carefully lay out all work in advance of fabrication and erection in order to meet the requirements of the extremely limited spaces. Where conflicts occur the Contractor shall meet with all involved trades and the Owner's Representative and resolve the conflict prior to erection of any work in the area involved.
   3. All piping not directly buried in the ground shall be considered as “interior piping.”
   4. Prior to the installation of any ceiling material, gypsum, plaster, or acoustical board, the Contractor shall notify the Owner's Representative so that arrangements
can be made for an inspection of the above-ceiling area about to be “sealed off.” The Contractor shall give as much advance notice as possible up to ten (10) working days, but in no case less than five (5) working days.

5. The purpose of this inspection is to verify the completeness and quality of the installation of the air conditioning systems, the plumbing systems, and any other special above-ceiling systems such as pneumatic tube. The ceiling supports (tee bar or lath) should be in place so that access panel and light fixture locations are identifiable and so that clearances and access provisions may be evaluated.

6. No ceiling material shall be installed until the deficiencies listed from this inspection have been corrected to the satisfaction of the Owner's Representative.

3.8 CUTTING AND PATCHING

A. General: Cut and patch walls, floors, etc. resulting from work in existing construction or where made necessary by failure to provide proper openings or recesses in new construction.

B. Methods of Cutting: Openings cut through concrete and masonry shall be made with masonry saws and/or core drills and at such locations acceptable to the Owner's Representative. Impact-type equipment will not be used except where specifically acceptable to the Owner's Representative. Openings in concrete for pipes, conduits, outlet boxes, etc. shall be core drilled to exact size. Determine location of embedded conduit and reinforcing bars prior to cutting.

C. Restoration: All openings shall be restored to “as-new” condition under the appropriate specification section for the materials involved, and shall match remaining surrounding materials and/or finishes.

D. Masonry: Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Adequate supports shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc. shall be of the proper size and shape, and shall be installed in a manner acceptable to the Owner's Representative.

E. Plaster: All mechanical work in area containing plaster shall be completed prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.

F. Weakening: No cutting, boring, or excavating which will weaken the structure shall be undertaken.

3.9 ROOF PENETRATIONS AND FLASHING

A. Pipe and conduit ducts, pitch pockets, curb bases, and flashing compatible with the roofing installation shall be provided for roof penetrations. Provide framing or other support around all openings through roof as required to preserve the structural integrity of the roof system and make the penetration weathertight.
B. Provide 30-inch round or square flashing acceptable to the roofing trades at all roof and deck drain and sleeve flashing locations.

C. Roof curbs for all roofs except standing seam metal roofs shall be provided by the equipment supplier supplying the roof-mounted equipment, etc., and such curbs shall be installed by the roofing trades. Contractor shall coordinate all roof curb requirements with all trades and the roofing trades at the earliest possible stage of the project.

D. Roof curbs for standing seam metal roofs shall be provided by the roofing trades. Curb base size, height, and type shall be coordinated with the roofing trades at the earliest possible stage of the project.

E. Flashing for pipe and conduit penetrations of standing seam metal roofs shall be provided and installed by the roofing trades.

3.10 EXCAVATING AND BACKFILLING

A. Perform trenching, excavating, backfilling for mechanical work as set forth below.

B. Depth of excavation to provide a minimum of 3 feet above top of pipe. Excavation to be carried to a depth of at least 6 inches below bottom of pipe elevation. Fill below pipe (6 inches), around pipe, and a minimum of 12 inches above pipe with sand of Class “B” crushed stone tamped firm and even. Separate topsoil during excavation. Final layer of dirt (12 inches minimum) to be topsoil. Trenches to be at least 18 inches wider than pipe with batter boards placed every 25 feet. Backfilling shall be done to exclude use of rock or stone above sand or Class “B” crushed stone.

3.11 TESTS AND INSPECTIONS

A. General: The Contractor shall make all tests deemed necessary by the inspection departments of the authority having jurisdiction, Board of Underwriters, etc. He shall provide all equipment, materials, and labor for making such tests. Fuel and electrical energy for system operational tests following beneficial occupancy by the Owner will be paid for by the Owner.

B. Other: Additional tests specified hereinafter under the various specifications sections shall be made.

C. Notification: The Owner's Representative shall be notified at his office 36 hours prior to each test and other specifications requirements requiring action on the part of the Owner, Architect, Engineer, and/or Owner's Representative.

D. Test Logs: All tests which the Contractor conducts shall have pertinent data logged by the Contractor at the time of testing. Data shall include date, time, personnel, description and extent of system tested, test conditions, test results, specified results, and any other pertinent data. Data shall be delivered to the Owner's Representative as specified under “Requirements for Final Acceptance.”
E. Inspections: In general, an inspection by the Owner's Representative shall be required prior to closing up any work and prior to beneficial occupancy or final project completion. The closing up of work includes, but is not limited to, pipe and conduit installations prior to backfilling; mechanical, electrical, and fire protection work prior to placement of concrete; or closing up walls and overhead mechanical, electrical, and fire protection work prior to installation of the ceiling.

3.12 CLEANING AND PAINTING

A. Thoroughly clean and touch up the finish on all parts of the materials and equipment. Exposed parts in equipment rooms, and all other spaces except sealed chases and attics shall be thoroughly cleaned of cement, plaster, and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out.

B. Exposed metal work which is not galvanized shall be carefully brushed down with steel brushes to remove rust and other spots and left smooth and clean and then painted with a suitable rust resistant primer. Exposed metal work includes work exterior to the building; exposed in mechanical or electrical equipment rooms and storage rooms; and other areas where occupants could see the work, whether normally occupied or not.

C. All other painting shall be accomplished under the Painting Section of Division 9 of the specifications.

3.13 DISCHARGE OF WASTES FROM CONSTRUCTION SITE

A. The Contractor shall comply with all applicable provisions of local, state, and federal laws regarding the discharge of wastes into sewer and waterways. Special caution shall be exercised to prevent the discharge of wastes which contain oil, tar, asphalt, roofing compound, kerosene, gasoline, paint, mud, cement, lime, or other materials which would degrade the water quality of the receiving water course. The Contractor shall construct and maintain oil interceptors, settling basins, acid neutralization tanks, and/or other effective pollution countermeasures, as required by the Texas Water Quality Board.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Mechanical Sections.
   1. Piping materials and installation instructions common to most piping systems.
   2. Concrete base construction requirements.
   3. Escutcheons.
   4. Dielectric fittings.
   5. Dielectric isolation tape
   6. Flexible connectors.
   7. Mechanical sleeve seals.
   8. Nonshrink grout for equipment installations.
   10. Installation requirements common to equipment specification sections.
   11. Mechanical demolition.
   12. Cutting and patching.
   13. Touchup painting and finishing.
   14. Access Doors

B. Pipe and pipe fitting materials are specified in mechanical piping system Sections, if applicable.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
F. The following are industry abbreviations for plastic materials:
   2. CPVC: Chlorinated polyvinyl chloride plastic.
   3. NP: Nylon plastic.
   4. PE: Polyethylene plastic.
   5. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:
   1. CR: Chlorosulfonated polyethylene synthetic rubber.
   2. EPDM: Ethylene propylene diene terpolymer rubber.

1.3 SUBMITTALS

A. Product Data: For dielectric fittings, flexible connectors, access doors, solder/brazing material and mechanical sleeve seals.

B. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

C. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:
   1. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
   2. Equipment and accessory service connections and support details.
   3. Fire-rated wall and floor penetrations.
   4. Scheduling, sequencing, movement, and positioning of large equipment into building during construction.
   5. Access panel and door locations

1.4 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.5 DELIVERY, STORAGE, AND HANDLING
A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate Mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces.

G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dielectric Tape:
   a. Holdrite (#272-4).

2. Metal, Flexible Connectors:
   a. Flexicraft Industries.
   b. Flex-Hose, Co., Inc.
c. Grinnell Corp.; Grinnell Supply Sales Co.
d. Mercer Rubber Co.
e. Metraflex Co.
f. Uniflex, Inc.
3. Rubber, Flexible Connectors:
a. General Rubber Corp.
b. Mercer Rubber Co.
c. Metraflex Co.
d. Red Valve Co., Inc.
e. Uniflex, Inc.
4. Mechanical Sleeve Seals:
a. Calpico, Inc.
b. Metraflex Co.
c. Thunderline/Link-Seal.

2.2 PIPE AND PIPE FITTINGS

A. Refer to individual Specification piping Sections for pipe and fitting materials and joining methods, if applicable.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Specification piping Sections for special joining materials not listed below, if applicable.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
   2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32.
   1. ASTM B 32, 95/5 lead-free alloys. Include water-flushable and soluble flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8.
   1. BCuP Series: Copper-phosphorus alloys.
2. BAg1: Silver alloy.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements: Manufacturer’s standard solvent cements for the following:
   1. CPVC Piping: ASTM F 493.
   2. PVC Piping: ASTM D 2564, medium bodied (bond). Include purple primer according to ASTM F 656.


J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon-steel bolts and nuts.

K. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.
   2. Followers: ASTM A 47 malleable iron or ASTM A 536 ductile iron.
   5. Finish: Enamel paint.

2.4 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature, to prevent galvanic action and stop corrosion. Unions in first paragraph below are available in at least NPS 1/2 to NPS 2.

B. Dielectric Unions:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      b. Central Plastics Company.
      c. EPCO Sales, Inc.
      d. Hart Industries International, Inc.
      e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      f. Zurn Mechanical Products Group; Wilkins Water Control Products.
   2. Description:
      a. Pressure Rating: 250 psig at 180 deg F.
      b. End Connections: Solder-joint copper alloy and threaded ferrous.
      c. Flanges in first paragraph below are available in at least NPS 1-1/2 to NPS 4.

C. Dielectric Flanges:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
b. Central Plastics Company.
c. EPCO Sales, Inc.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:
   a. Factory-fabricated, bolted, companion-flange assembly.
   b. Pressure Rating: 175 psig minimum.
   c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Advance Products & Systems, Inc.
      b. Calico, Inc.
      c. Central Plastics Company.
      d. Pipeline Seal and Insulator, Inc.
   2. Description:
      a. Nonconducting materials for field assembly of companion flanges.
      b. Pressure Rating: 150 psig.
      c. Gasket: Neoprene or phenolic.
      d. Bolt Sleeves: Phenolic or polyethylene.
      e. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Calpico, Inc.
      b. Lochinvar Corporation.
   2. Description:
      a. Galvanized-steel coupling.
      b. Pressure Rating: 300 psig at 225 deg F.
      c. End Connections: Female threaded.
      d. Lining: Inert and noncorrosive, thermoplastic.

F. Dielectric Nipples:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Perfection Corporation; a subsidiary of American Meter Company.
      b. Precision Mechanical Products, Inc.
      c. Victaulic Company.
   2. Description:
      a. Electroplated steel nipple complying with ASTM F 1545.
      b. Pressure Rating: 300 psig at 225 deg F.
      c. End Connections: Male threaded or grooved.
      d. Lining: Inert and noncorrosive, propylene.

2.5 DIELECTRIC ISOLATION TAPE
A. Tape to eliminate dissimilar metal contact: (equal to Holdrite #272-4)
   1. White Polyester Felt. Pressure sensitive adhesive rubber base (one side only).
   2. 4” width.

2.6 FLEXIBLE CONNECTORS

A. General: Fabricated from materials suitable for system fluid and that will provide flexible pipe connections. Include 125-psig minimum working-pressure rating, unless higher working pressure is indicated, and ends according to the following:
   1. 2-Inch NPS and Smaller: Threaded.
   2. 2-1/2-Inch NPS and Larger: Flanged.
   3. Option for 2-1/2-Inch NPS and Larger: Grooved for use with keyed couplings.

B. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.

C. Rubber, Flexible Connectors: CR or EPDM elastomer rubber construction, with multiple plies of NP fabric, molded and cured in hydraulic presses. Include 125-psig minimum working-pressure rating at 220 deg F. Units may be straight or elbow type, unless otherwise indicated.

2.7 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
   1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe materials and size of pipe.
   2. Pressure Plates: Stainless steel.
   3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.8 PIPING SPECIALTIES

A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
   1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
   2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
   3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
   4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
      a. Underdeck Clamp: Clamping ring with set screws.
   5. Sleeve Fasteners: Manufactured, steel clips for securement during pour. Equal to B-line, BD40, BE-5-8 or BE-9-12.
B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.
   1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
   2. OD: Completely cover opening.
   3. Cast Brass: One piece, with set screw. (split face acceptable for existing piping)

2.9 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
   2. Design Mix: 5000-psig, 28-day compressive strength.

2.10 ACCESS DOORS

A. General: Provide access doors for all serviceable mechanical appurtenances (valves, trap primers, shock arresters, actuators, sensors, etcetera) in inaccessible locations. Such locations include gypsum, brick and CMU ceilings and walls.

B. Location of panels shall be carefully coordinated with other Exposed Devices as described in earlier paragraphs.

C. Manufacturers shall be Milcor, Mifab, or approved equal. Unless indicated otherwise, use panels equal to Milcor Style M for masonry and drywall construction, equal to Milcor Style K for plastered masonry walls and ceilings. Stainless steel panels shall be used in ceramic tile or glazed structural tile.

D. Minimum construction features include 16-gage frame and door, continuous hinges, cam-style latch and 10x10" unobstructed opening size.

E. UL labeled when in fire-rated construction, one and one-half hour rating.

F. Access doors located outside, in restrooms or in a moisture-laden environment (dressing area, shower area, lockers, etcetera) shall be stainless steel construction.

G. Equipment access doors shall be of sufficient size to remove/replace equipment and provide routine maintenance as necessary, unless otherwise noted. Doors shall be set flush with adjacent finish surfaces. All access doors shall be provided with cylinder locks. All access doors (MEP) shall have one (1) common key.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS AND APPLICATIONS

BASIC MECHANICAL MATERIALS AND METHODS – 23 05 13.8
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A. General: Install piping as described below, unless piping Sections specify otherwise. Individual piping Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

C. All piping to be installed in compliance with current NEC required clearances.

D. Install manufactured isolation clamps at all dissimilar metal pipe supports. Install dielectric isolation tape (engineer approved) only when a manufactured isolation clamp is not available.

E. Install piping at indicated slope.

F. Install components with pressure rating equal to or greater than system operating pressure.

G. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

H. Install piping free of sags and bends.

I. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

J. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

K. Install piping to allow application of insulation plus 1-inch clearance around insulation.

L. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

M. Install fittings for changes in direction and branch connections.

N. Install couplings according to manufacturer's written instructions.

O. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Section "Penetration Firestopping" for firestop materials and installations.
   1. Fire-stop all sleeves at floor penetrations of multistory buildings including underfloor penetrations.

P. Verify final equipment locations for roughing-in.
Q. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

R. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
   c. Align threads at point of assembly.
   d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
   e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
8. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:
   a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   b. CPVC Piping: ASTM D 2846 and ASTM F 493.
   c. PVC Pressure Piping: ASTM D 2672.
   d. PVC Nonpressure Piping: ASTM D 2855.
   a. Plain-End Pipe and Fittings: Use butt fusion.
   b. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.2 ESCUTCHEON REQUIREMENTS

A. Install escutcheons at pipe penetrations of walls, ceilings, and floors in finished areas.
   1. Escutcheons for New Piping:
      a. Piping exposed through floors and walls in finished areas: One piece, cast brass with polished chrome-plated finish with set screw. Deep escutcheons to be provided where standard depth will not fit.
      b. Escutcheons shall cover entire hole penetration.
      c. Escutcheon to be appropriately sized for pipe.
   2. Escutcheons for Existing piping:
      a. Piping exposed through floors and walls in finished areas: Split plate, cast brass with polished chrome-plated finish with set screw. Deep escutcheons to be provided where standard depth will not fit.
      b. Escutcheons shall cover entire hole penetration.
      c. Escutcheon to be appropriately sized for pipe.
   3. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.3 PIPE SLEEVE INSTALLATION REQUIREMENTS

A. Pipe sleeves are required at all through wall and floor penetrations.
   1. Sleeves are to be of the following material:
      a. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.
   2. Sleeves are required for all through floor and wall penetrations. Sleeves to be set and poured in place (in slab applications), secure all sleeves with fasteners.
   3. Sleeves to extend 2 inches past face of floor or wall. Pipe sleeve in finished areas to be flush with wall or floor for installation of escutcheon.
   4. Install sleeves in new partitions, slabs, and walls as they are built.
   5. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Section "Joint Sealants" for joint sealants.
   6. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Section "Joint Sealants" for joint sealants.
   7. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.
   8. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
Seal annular space with water tight sealant. (equal to NP-1). All sleeves and penetrations to maintain rating of wall / floor. Seal pipe penetrations with fire-stopping materials.

9. Install sleeve materials according to the following applications:
   a. Sleeves for Piping Passing through Concrete Floor Slabs: galvanized steel pipe.
   b. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe sleeves.
      1) Extend sleeves 2 inches above finished floor level.
      2) For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Comply with requirements in Section "Sheet Metal Flashing and Trim" for flashing.

10. Sleeves for Piping Passing through Gypsum-Board Partitions:
    a. Galvanized-steel pipe sleeves.
    b. Exception: Sleeves are not required for water supply tubes and waste pipes for individual mechanical fixtures if escutcheons will cover openings.

11. Sleeves for Piping Passing through Concrete Roof Slabs: Reference details.

12. Sleeves for Piping Passing through Exterior Concrete Walls:
    a. Galvanized-steel pipe sleeves.
    b. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.

13. Sleeves for Piping Passing through Interior Concrete Walls:
    a. Galvanized-steel pipe sleeves.

14. Mechanical sleeve seals
    a. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building. Sleeves must be poured in place. Installation of sleeves after wall is constructed is not acceptable.
    b. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

B. Piping Connections: Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
   2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

3.4 DIELECTRIC FITTING INSTALLATION

A. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.

B. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.

3.5 EQUIPMENT INSTALLATION – COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment giving right of way to piping installed at required slope.

3.6 PAINTING AND FINISHING

A. Apply paint to exposed piping according to the following, unless otherwise indicated:
   1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
   2. Interior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
   5. Exterior, Galvanized-Steel Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
B. Do not paint piping specialties with factory-applied finish.

C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment (not to be used at pipe supports).

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.9 DEMOLITION

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.10 CUTTING AND PATCHING

A. Disconnect, demolish, and remove Work specified in Mechanical Sections.

B. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

D. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches beyond face of adjacent construction. Cap and patch surface to match existing finish.

E. Removal: Remove indicated equipment from Project site.

F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.
GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's written instructions.

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. This Section includes the following hangers and supports for plumbing system piping and equipment:
   1. Steel pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Metal framing systems.
   4. Thermal-hanger shield inserts.
   5. Fastener systems.
   6. Pipe positioning systems.
   7. Equipment supports.

B. Related Sections include the following:
   1. Specification Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
   2. Specification Section “Metal Ducts” for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
1.5 SUBMITTALS

A. Product Data: For the following:
   1. Steel pipe hangers and supports.
   2. Thermal-hanger shield inserts.
   3. Powder-actuated fastener systems.
   4. Pipe positioning systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
   1. Trapeze pipe hangers. Include Product Data for components.
   2. Metal framing systems. Include Product Data for components.
   3. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

B. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 METAL COATING REQUIREMENTS:

A. All metal products shall have the following coatings:
   1. Wet/damp areas: hot dipped galvanized.
   2. Dry or conditioned areas: pre-galvanized.

2.3 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:
   1. AAA Technology & Specialties Co., Inc.
2. Bergen-Power Pipe Supports.
4. Carpenter & Paterson, Inc.
5. Empire Industries, Inc.
6. ERICO/Michigan Hanger Co.
7. Globe Pipe Hanger Products, Inc.
8. Grinnell Corp.
9. GS Metals Corp.
11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.

C. Galvanized, Metallic Coatings: Pre-galvanized (minimum thickness of 0.5 mils) or hot dipped (1.4 to 3.9 mil thickness).

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.4 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.5 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:
   2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
   3. GS Metals Corp.
   5. Thomas & Betts Corporation.
   6. Tolco Inc.
   7. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
2.6 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig minimum, compressive-strength insulation insert with a sheet metal shield.

B. Manufacturers:
   1. Carpenter & Paterson, Inc.
   2. ERICO/Michigan Hanger Co.
   3. PHS Industries, Inc.
   4. Pipe Shields, Inc.
   5. Rilco Manufacturing Company, Inc.
   6. Buckaroos

C. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with vapor barrier. Wood inserts are not acceptable.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. Insulation-Insert Material for Hot Piping only, up to 3” diameter: Molded fiberglass block, 20 lbs/ft$^3$ density, thermal conductivity of 0.30.

F. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

G. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

H. Insert Length: Extend 4 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.7 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Manufacturers:
      b. Empire Industries, Inc.
      c. Hilti, Inc.
      d. ITW Ramset/Red Head.
      e. MKT Fastening, LLC.
      f. Powers Fasteners.

2.8 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Manufacturers:
2. HOLDRITE Corp.; Hubbard Enterprises.
3. Samco Stamping, Inc.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars.
   2. Interior: Black steel.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
   2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30.
   2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
   3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated stationary pipes, NPS 3/4 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 2.
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
   a. Light (MSS Type 31): 750 lb.
   b. Medium (MSS Type 32): 1500 lb.
   c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
   2. Thermal-Hanger Shield Inserts: For supporting insulated cold pipe. Wood inserts are not acceptable.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
   2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
   3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
   4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
   5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
   6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
   7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
   8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
      a. Horizontal (MSS Type 54): Mounted horizontally.
      b. Vertical (MSS Type 55): Mounted vertically.
      c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure; attaching to metal roof decks is not permissible.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Specification Section "Plumbing Fixtures" for plumbing fixtures.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.


I. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts
before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

N. Insulated Piping: Comply with the following:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
   3. Install thermal-hanger shield inserts on insulated piping with vapor barrier. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
   4. Shield Dimensions for Pipe: Not less than the following:
      a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
      b. NPS 4: 12 inches long and 0.06 inch thick.
      c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   5. Insert Material: Length at least as long as protective shield.
   6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

O. Insulated Ducts (Mineral Fiber Blanket). Comply with the following:
   1. At all unistrut supports provide mineral fiber board insert in between ductwork and unistrut. Insert to extend 12” on both sides of unistrut, full length of strut. Extend blanket between structural insert.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.
3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. This Section includes the following mechanical identification materials and their installation:
      1. Equipment nameplates.
      2. Equipment markers.
      3. Equipment signs.
      4. Access panel and door markers.
      5. Pipe markers.
      6. Duct markers.
      7. Stencils.
      8. Valve tags.
     10. Warning tags.

1.3 SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted
      copies) to include in maintenance manuals. Reproduce on 8½ x 11 bond. Tabulate valve
      number, piping system, system abbreviation as shown on tag, room or space location of
      valve, and variations for identification. Mark valves intended for emergency shutoff and
      similar special uses. Indicate normal operating positions (open, closed, modulating, or
      balance).

1.4 QUALITY ASSURANCE
   A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping
      Systems," for letter size, length of color field, colors, and viewing angles of identification
      devices for piping.

1.5 COORDINATION
   A. Coordinate installation of identifying devices with completion of covering and painting of
      surfaces where devices are to be applied.
   B. Coordinate installation of identifying devices with location of access panels and doors.
   C. Install identifying devices before installing acoustical ceilings and similar concealment.
PART 2 - PRODUCTS

2.1 GENERAL

A. Products specified are for applications referenced in other Mechanical sections. In addition to a factory installed equivalent nameplate, all equipment shall have an engraved equipment sign that matches the schedule tag name.

2.2 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
   1. Data:
      a. Manufacturer, product name, model number, and serial number.
      b. Capacity, operating and power characteristics, and essential data.
      c. Labels of tested compliances.
   2. Location: Accessible and visible.
   3. Fasteners: As required to mount on equipment.

B. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
   1. Data: Instructions for operation of equipment and for safety procedures.
   2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
   3. Thickness: 1/8 inch, unless otherwise indicated.
   4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.3 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Manufacturers standard preprinted, semi-rigid, snap-on type.
   1. Colors: Comply with ASME A13.1, unless otherwise indicated.
   2. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
   3. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
   4. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
   5. Lettering: Manufacturers standard preprinted.

2.4 DUCT IDENTIFICATION DEVICES

A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive. See Execution section for color scheme.

2.5 VALVE TAGS
A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Provide 5/32-inch hole for fastener.
   1. Material: 0.032-inch thick aluminum.
   3. Size: 1½ inches in diameter, unless otherwise indicated.

2.6 VALVE SCHEDULES

A. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.

B. Frame: Extruded aluminum.

C. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.7 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
   1. Size: 3 by 5-1/4 inches minimum.
   2. Fasteners: Brass grommet and wire.
   3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Mechanical Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
   1. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
   2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
   3. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
   4. Fans, blowers, primary balancing dampers, and mixing boxes.
   5. Packaged HVAC central-station and zone-type units.

B. Install equipment markers with permanent fasteners on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.

3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
   a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   b. Fire department hose valves and hose stations.
   c. Meters, gages, thermometers, and similar units.
   d. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
   e. Pumps, compressors, chillers, condensers, and similar motor-driven units.
   f. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
   g. Fans, blowers, primary balancing dampers, and mixing boxes.
   h. Packaged HVAC central-station and zone-type units.
   i. Tanks and pressure vessels.
   j. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

C. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.

1. Identify mechanical equipment with equipment markers in the following color codes:
   a. Green: For cooling equipment and components.
   b. Yellow: For heating equipment and components.
   c. Green and Yellow, Orange: For combination cooling and heating equipment and components.
   d. Brown: For energy-reclamation equipment and components.

2. Letter Size: Minimum 1/2 inch for name of units if viewing distance is less than 24 inches, 3/4 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.

4. Include signs for the following general categories of equipment:
   a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   b. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
   c. Pumps, compressors, chillers, condensers, and similar motor-driven units.
   d. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
   e. Fans, blowers, primary balancing dampers, and mixing boxes.
   f. Packaged HVAC central-station and zone-type units.
   g. Tanks and pressure vessels.
   h. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

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D. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
   1. Pipes with OD, Including Insulation, Less Than 6 Inches: Snap-on application of pretensioned, semi-rigid plastic pipe marker.
   2. Pipes with OD, Including Insulation, 6 Inches and Larger: Shaped pipe markers. Use size to match pipe and secure with manufacturer’s stainless steel bands.
   3. Fasten Option: Laminated or bonded application of pipe marker to pipe or insulation.

B. Locate pipe markers and color bands where piping is exposed in finished spaces; in machine rooms; in accessible maintenance spaces such as shafts, tunnels and plenums; and in exterior nonconcealed locations such as rooftops and chiller yards, as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
   7. On piping above removable acoustical ceilings.

3.4 DUCT IDENTIFICATION

A. Install duct markers with permanent adhesive on air ducts in the following color codes:
   1. Green: For cold-air supply ducts.
   2. Yellow: For hot-air supply ducts.
   3. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
   4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
   5. Letter Size: Minimum 1/2 inch for name of units if viewing distance is less than 24 inches, 3/4 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

B. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system. Reduce intervals to 25 feet in areas of high duct congestion.

3.5 VALVE-SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.
3.7 VALVE TAGS

A. Install on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, plumbing fixture supply stops, shutoff valves, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in valve schedule.

B. Valve Tag Application Schedule: Tag valves according to size, shape, color scheme, and with captions similar to those indicated in the following:

C. Tag Material: Aluminum.

D. Tag Size and Shape: 1-1/2 inches, round.

E. Tag Color: According to the following:
   2. Cold Water: Black.
   3. Hot Water: Red.
   7. Steam: Red.


G. Install mounted valve schedule in each major equipment room.

3.8 EQUIPMENT SIGNS AND MARKERS

A. Install engraved plastic-laminate signs or equipment markers on or near each major item of mechanical equipment. Include signs for the following general categories of equipment:
   1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   2. Meters, gages, thermometers, and similar units.
   3. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
   4. Pumps, compressors, chillers, condensers, and similar motor-driven units.
   5. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
   6. Fans, blowers, primary balancing dampers, and mixing boxes.
   7. Packaged HVAC central-station and zone-type units.
   8. Tanks and pressure vessels.
   9. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
   10. Any concealed appurtenances requiring access for maintenance shall be clearly identified by sign (to include but not be limited to unions, strainers, valves, etc.).

B. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows showing service and direction of flow.
   1. Location: Locate signs near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.9 ADJUSTING AND CLEANING
A. Relocate mechanical identification materials and devices that have become visually blocked by work of this or other Divisions.

B. Clean faces of identification devices and glass frames of valve charts.

END OF SECTION
SECTION 23 05 93

TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work included in this section consists of the furnishing of all labor, instruments, tools, and services required in connection with the testing, adjusting and balancing (TAB) of the heating, ventilating, and air conditioning systems as described in the mechanical specifications and/or shown on the mechanical plans, or reasonable implied therefrom.

B. TAB of the HVAC systems will be performed by an impartial technical firm that is a member of NEBB and whose operations are limited to the field of professional testing and balancing.

C. Mechanical Contractor to obtain TAB services from an independent TAB contractor.

D. Qualified TAB firms shall submit cost, scope of work, qualifications, time line, and references.

E. The TAB firm is responsible to and shall submit five (5) copies of all reports directly to the Architect/Engineer and one copy to the Owner.

F. TAB services shall result in the optimum temperature, airflow, and noise levels in the conditioned space of the project.

G. The following basic components of the HVAC systems shall be tested, adjusted, and balanced:
   1. Air distribution systems.
   2. Air moving equipment.
   3. HVAC pumps (chilled water, hot water, condenser water, etc.).
   5. Control systems verification.

1.2 SUMMARY

A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:
   1. Balancing airflow and water flow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
   2. Adjusting total HVAC systems to provide indicated quantities.
   4. Setting quantitative performance of HVAC equipment.
5. Verifying that automatic control devices are functioning properly.
7. Reporting results of the activities and procedures specified in this Section.

B. Related sections include the following:
   1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment. See all related HVAC mechanical sections.
   2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

1.3 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

E. Report Forms: Test data sheets for recording test data in logical order.

F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

K. Test: A procedure to determine quantitative performance of a system or equipment.

L. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.
M. **NEBB:** National Environmental Balancing Bureau.

N. **SMACNA:** Sheet Metal and Air Conditioning Contractors' National Association.

### 1.4 **SUBMITTALS**

A. **Quality-Assurance Submittals:** Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.

B. **Contract Documents Examination Report:** Within 45 days from the Contractor’s Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3 of this Section.

C. **Strategies and Procedures Plan:** Within 60 days from the Contractor’s Notice to Proceed, submit 2 copies of the testing, adjusting and balancing strategies and step-by-step procedures as specified in Part 3 “Preparation” Article below. Include a complete set of report forms intended for use on this Project.

D. **Certified Testing, Adjusting and Balancing Reports:** Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting and balancing Agent.

E. **Sample Report Forms:** Submit 2 sets of sample testing, adjusting and balancing report forms.

F. **Warranty:** Submit 2 copies of special warranty specified in the “Guarantee” Article below.

### 1.5 **QUALITY ASSURANCE**

A. **Agent Qualifications:** Engage a testing, adjusting, and balancing agent certified by NEBB.

B. **Testing, Adjusting, and Balancing Conference:** Meet with the Owner's and the Architect's representatives on approval of the testing, adjusting, and balancing strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of testing, adjusting, and balancing team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days' advance notice of scheduled meeting time and location.

1. **Agenda Items:** Include at least the following:
   a. Submittal distribution requirements.
   c. Testing, adjusting, and balancing plan.
   d. Work schedule and Project site access requirements.
e. Coordination and cooperation of trades and subcontractors.

f. Coordination of documentation and communication flow.

C. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.

2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.


E. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

F. Instrumentation Calibration: Calibrate instruments at least every 12 months or more frequently if required by the instrument manufacturer.

1.6 PROJECT CONDITIONS

A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.7 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

B. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.

C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 GUARANTEE

A. General: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.
   1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
   2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine Architect's and Engineer's design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

D. Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

E. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

F. Examine system and equipment test reports.

G. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
H. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

I. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible and their controls are connected and functioning.

K. Examine plenum ceilings, utilized for supply air, to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.

L. Examine strainers for clean screens and proper perforations.

M. Examine 3-way valves for proper installation for their intended function of diverting or mixing fluid flows.

N. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

O. Examine open-piping-system pumps to ensure absence of entrained air in the suction piping.

P. Examine equipment for installation and for properly operating safety interlocks and controls.

Q. Examine automatic temperature system components to verify the following:
   1. Dampers, valves, and other controlled devices operate by the intended controller.
   2. Dampers and valves are in the position indicated by the controller.
   3. The Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
   4. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
   5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
   6. Sensors are located to sense only the intended conditions.
   7. Sequence of operation for control modes is according to the Contract Documents.
   8. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
   9. Interlocked systems are operating.
   10. Changeover from heating to cooling mode occurs according to design values.

R. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.2 PREPARATION
A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:
   1. Permanent electrical power wiring is complete.
   2. Hydronic systems are filled, clean, and free of air.
   3. Automatic temperature-control systems are operational.
   4. Equipment and duct access doors are securely closed.
   5. Balance, smoke, and fire dampers are open.
   6. Isolating and balancing valves are open and control valves are operational.
   7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
   8. Windows and doors can be closed so design conditions for system operations can be met.
   9. Motors are wired properly with appropriate overloads and correct rotation.

3.3 GENERAL TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.4 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
E. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling unit components.

3.5 VARIABLE-AIR-VOLUME SYSTEMS' ADDITIONAL PROCEDURES

A. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Balance systems similar to constant-volume air systems.
2. Set terminal units and supply fan at full-airflow condition.
3. Adjust inlet dampers of each terminal unit to design airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
4. Readjust fan airflow for final maximum readings.
5. Measure operating static pressure at the sensor that controls the supply fan, if one is installed, and verify operation of the static-pressure controller.
6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.
   a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.
8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

3.6 FUNDAMENTAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
1. Open all manual valves for maximum flow.
2. Check expansion tank liquid level.
3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation and set at design flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type, unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.7 HYDRONIC SYSTEMS' BALANCING PROCEDURES

A. Determine water flow at pumps. Use the following procedures, except for positive-displacement pumps:
   1. Verify impeller size by operating the pump with the discharge valve closed. Verify with the pump manufacturer that this will not damage pump. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on the manufacturer's pump curve at zero flow and confirm that the pump has the intended impeller size.
   2. Check system resistance. With all valves open, read pressure differential across the pump and mark the pump manufacturer's head-capacity curve. Adjust pump discharge valve until design water flow is achieved.
   3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on the pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
   4. Report flow rates that are not within plus or minus 5 percent of design.

B. Set calibrated balancing valves, if installed, at calculated presettings.

C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
   1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than design flow.

E. Adjust balancing stations to within specified tolerances of design flow rate as follows:
   1. Determine the balancing station with the highest percentage over design flow.
   2. Adjust each station in turn, beginning with the station with the highest percentage over design flow and proceeding to the station with the lowest percentage over design flow.
3. Record settings and mark balancing devices.

F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures, including outdoor-air temperature.

G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.8 VARIABLE-FLOW HYDRONIC SYSTEMS' ADDITIONAL PROCEDURES

A. Balance systems with automatic 2- and 3-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.9 PRIMARY-SECONDARY-FLOW HYDRONIC SYSTEMS' ADDITIONAL PROCEDURES

A. Balance the primary system crossover flow first, then balance the secondary system.

3.10 MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
   1. Manufacturer, model, and serial numbers.
   4. Efficiency rating if high-efficiency motor.
   5. Nameplate and measured voltage, each phase.
   6. Nameplate and measured amperage, each phase.
   7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.11 BOILERS

A. Measure entering- and leaving-water temperatures and water flow.

3.12 HEAT-TRANSFER COILS

A. Water Coils: Measure the following data for each coil:
   1. Entering- and leaving-water temperatures.
   2. Water flow rate.
   3. Water pressure drop.
4. Dry-bulb temperatures of entering and leaving air.
5. Wet-bulb temperatures of entering and leaving air.
6. Airflow.
7. Air pressure drop.

B. Electric-Heating Coils: Measure the following data for each coil:
1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperatures at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kW at full load.
6. Fuse or circuit-breaker rating for overload protection.

3.13 TEMPERATURE TESTING

A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of 2 successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.14 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Verify free travel and proper operation of control devices such as damper and valve operators.

F. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.

G. Confirm interaction of electrically operated switch transducers.

H. Confirm interaction of interlock and lockout systems.

I. Verify main control supply-air pressure and observe compressor and dryer operations.
J. Record voltages of power supply and controller output. Determine if the system operates on a grounded or nongrounded power supply.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.15 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:
   1. Supply, Return, and Exhaust Fans: -5 to plus 10 percent.
   2. Air Outlets and Inlets: ± 10 percent.
   3. Heating-Water Flow Rate: ± 10 percent.
   4. Cooling-Water Flow Rate: ± 5 percent.

3.16 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

C. Preliminary Report: Submit preliminary TAB reports to the design engineer for each floor, the central plant, and the chilled and hot water hydronic system.

3.17 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
   1. Include a list of the instruments used for procedures, along with proof of calibration.

C. Final Report Final Report Contents: In addition to the certified field report data, include the following:
   1. Pump Curves.
   2. Fan curves.
   3. Manufacturers’ test data.
   4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance, but not include approved Shop Drawings and Product Data.

D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
   1. Title page.
   2. Name and address of testing, adjusting and balancing Agent.
   3. Project name.
   4. Project location.
   5. Architect’s name and address.
   6. Engineer’s name and address.
   7. Contractor’s name and address.
   9. Signature of testing, adjusting and balancing Agent who certifies the report.
  10. Summary of contents, including the following:
      a. Design versus final performance.
      b. Notable characteristics of systems.
      c. Description of system operation sequence if it varies from the Contract Documents.
  11. Nomenclature sheets for each item of equipment.
  12. Data for terminal units, including manufacturer, type size and fittings.
  13. Notes to explain why certain final data in the body of reports vary from design values.
  14. Test conditions for fans and pump performance forms, including the following:
      a. Settings for outside-return-and exhaust-air dampers.
      b. Conditions of filters.
      c. Cooling coil, wet-and dry-bulb, conditions.
      d. Face and bypass damper settings at coils.
      e. Fan drive settings, including settings and percentage of maximum pitch diameter.
      f. Inlet vane settings for variable-air-volume, systems.
      g. Settings for supply-air, static-pressure, controller.
      h. Other system operating conditions that affect performance.

E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:
   1. Quantities of outside, supply, return and exhaust airflows.
   2. Water and steam flow rates.
   3. Duct, outlet and inlet sizes.
   4. Pipe and valve sizes and locations.
   5. Terminal units.
   7. Locations of duct traverse(s) of duct layout.

F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
   1. Unit Data: Include the following:
a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer’s serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches and bore.
i. Sheave dimension, center-to-center and amount of adjustments in inches (mm).
j. Number of belts, make and size.
k. Number of filters, type and size.

2. Motor Data: Include the following:
a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches and bore.
f. Sheave dimensions, center-to-center and amount of adjustments in inches.

3. Test Data: Include design and actual values for the following:
a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer’s serial number.

G. Apparatus-Coil Test Reports: For apparatus coils, include the following:
1. Coil Data: Include the following:
a. System Identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch.
f. Make and model number.
g. Face area in sq.ft.
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data: Include design and actual values for the following:
a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outside-air, wet and dry-bulb temperatures in deg F.
e. Return-air, wet and dry-bulb temperatures in deg F.
f. Entering-air, wet and dry-bulb temperatures in deg F.
g. Leaving-air, wet and dry bulb temperatures in deg F.

h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.

H. Water Chiller Test Reports: For chillers (Air Cooled or Water Cooled)
1. Unit Data: Include the following:
   a. Unit Identification.
   b. Location.
   c. Make and type.
   d. Model number and unit size.
   e. Manufacturer’s serial number.
   f. Unit arrangement and class.
2. Motor Data:
   a. Make and frame type and size.
   b. Volts, phase and hertz.
   c. Full-load amperage and service factor.
3. Test Data:
   a. Total chilled water flow rate in gpm.
   b. Total condenser water flow rate in gpm.
   c. WPD in ft across chilled water.
   d. WPD in ft across condenser water.
   e. Chilled water supply and return temperatures °F.
   f. Condenser water supply and return temperatures in °F.

I. Cooling Tower Test Reports: For condenser water cooling tower:
1. Unit Data: Include the following:
   a. Unit identification.
   b. Location.
   c. Make and type.
   d. Model number and unit size.
   e. Manufacturer's serial number.
   f. Unit arrangement and class.
   g. Discharge arrangement.
2. Motor Data (Fan or Pump): Include the following:
   a. Make and frame type and size.
   b. Horsepower and rpm.
   c. Volts, phase, and hertz.
   d. Full-load amperage and service factor.
3. Test Data: Include design and actual values for the following:
   a. Total condenser under flow rate in gpm.
   b. Total wpd in ft across condenser water.
   c. Condenser water supply and return temperatures in °F.
   d. Fan rpm.

J. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:
1. Unit Data: Include the following:
   a. System identification.
   b. Location.
   c. Coil identification.
   d. Capacity in Btuh (kW).
   e. Number of stages.
   f. Connected volts, phase, and hertz.
   g. Rated amperage.
   h. Airflow rate in cfm.
   i. Face area in sq. ft.
   j. Minimum face velocity in fpm.

2. Test Data: Include design and actual values for the following:
   a. Heat output in Btuh.
   b. Airflow rate in cfm.
   c. Air velocity in fpm.
   d. Entering-air temperature in deg F.
   e. Leaving-air temperature in deg F.
   f. Voltage at each connection.
   g. Amperage for each phase.

K. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data: Include the following:
   a. System identification.
   b. Location.
   c. Make and type.
   d. Model number and size.
   e. Manufacturer's serial number.
   f. Arrangement and class.
   g. Sheave make, size in inches, and bore.
   h. Sheave dimensions, center-to-center and amount of adjustments in inches (mm).

2. Motor Data: Include the following:
   a. Make and frame type and size.
   b. Horsepower and rpm.
   c. Volts, phase, and hertz.
   d. Full-load amperage and service factor.
   e. Sheave make, size in inches, and bore.
   f. Sheave dimensions, center-to-center and amount of adjustments in inches.
   g. Number of belts, make, and size.

3. Test Data: Include design and actual values for the following:
   a. Total airflow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan rpm.
   d. Discharge static pressure in inches wg.
   e. Suction static pressure in inches wg.
L. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
   1. Report Data: Include the following:
      a. System and air-handling unit number.
      b. Location and zone.
      c. Locate traverse location on duct work layout.
      d. Traverse air temperature in deg F.
      e. Duct static pressure in inches wg.
      f. Duct size in inches.
      g. Duct area in sq. ft.
      h. Design airflow rate in cfm.
      i. Design velocity in fpm.
      j. Actual airflow rate in cfm.
      k. Actual average velocity in fpm.
      l. Barometric pressure in psig.

M. Air-Terminal-Device Reports: For terminal units, include the following:
   1. Unit Data: Include the following:
      a. System and air-handling unit identification.
      b. Location and zone.
      c. Test apparatus used.
      d. Area served.
      e. Air-terminal-device make.
      f. Air-terminal-device number from system diagram.
      g. Air-terminal-device type and model number.
      h. Air-terminal-device size.
      i. Air-terminal-device effective area in sq. ft.
   2. Test Data: Include design and actual values for the following:
      a. Airflow rate in cfm.
      b. Air velocity in fpm.
      c. Preliminary airflow rate as needed in cfm.
      d. Preliminary velocity as needed in fpm.
      e. Final airflow rate in cfm.
      f. Final velocity in fpm.
      g. Space temperature in deg F.

N. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
   1. Unit Data: Include the following:
      a. System and air-handling unit identification.
      b. Location and zone.
      c. Room or riser served.
      d. Coil make and size.
      e. Flowmeter type.
   2. Test Data: Include design and actual values for the following:
      a. Airflow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

O. Instrument Calibration Reports: For instrument calibration, include the following:
   1. Report Data: Include the following:
      a. Instrument type and make.
      b. Serial number.
      c. Application.
      d. Dates of use.
      e. Dates of calibration.

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes mechanical insulation for duct, equipment, and pipe, including the following:
   1. Insulation Materials:
      a. Cellular glass.
      b. Flexible elastomeric.
      c. Mineral fiber.
      d. Phenolic
   2. Adhesives.
   3. Mastics.
   4. Sealants.
   5. Factory-applied jackets.
   7. Field-applied tape.
   8. Field-applied jackets.
  10. Corner angles.

B. Related Sections include the following:
   1. Specification Section "Metal Ducts" for duct liners.
   2. Specification Section "Hangers and Supports" for high-density inserts at hangers; wood inserts at hangers are not acceptable.
   3. Specification Section “Special Conditions for All Mechanical Work”.
   4. Specification Section “Basic Mechanical Materials and Methods”.

C. Not all items listed within this specification are used. Use only items applicable per application schedule.

1.3 DEFINITIONS

A. ASJ: All-service jacket.

B. CONCEALED: Covered or concealed by a ceiling (gypsum or lay-in acoustical tile) or wall.
C. EXPOSED: Open to view; not concealed by a ceiling or wall of any sort.

D. FSK: Foil, scrim, kraft paper.

E. UNDERFLOOR: Accessible crawl space beneath lowest floor level. (considered “outdoors”)

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any). Provide submittal data on all products to be used.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

B. All products to be stored in a dry location, protected from the elements. All damaged insulation to be replaced.

1.7 COORDINATION

A. Coordinate size and location of supports, hangers, and high-density insulation inserts and shields specified in Specification Section "Hangers and Supports." Coordinate with drawing details where applicable; wood inserts at hangers are not acceptable.

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

C. Insulation not to be installed until building is dried in.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 INSULATION MATERIALS

A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Phenolic:
   1. Manufacturers:
      a. Resolco
      b. Dyplast Products
      c. Polyguard
      d. Approved equal.
   2. 100% CFC-free, HCFC-free, and halogen-free, closed cell rigid phenolic foam insulation.
   3. Minimal thermal conductivity @ 75° F
      a. Green, 2.5 lb/ft³: 0.15 (Btu.in/hr.ft². F)
      b. Pink, 5.0 lb/ft³: 0.21 (Btu.in/hr.ft². F)
G. Cellular Glass:
   1. Manufacturers:
      a. Pittsburgh Corning Corporation; Foamglas Super K.
   2. Block Insulation: ASTM C 552, Type I.
   3. Special-Shaped Insulation: ASTM C 552, Type III.
   4. Board Insulation: ASTM C 552, Type IV.
   5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
   6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
   7. Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Minimal thermal conductivity at 75° F of 0.27 (Btu.in/hr.ft². F) (R-value of 10.34@ 3 inches thickness). Factory-applied jacket requirements are specified in Part 2 “Factory-Applied Jackets” Article.

H. Flexible Elastomeric:
   1. Manufacturers:
      a. Aeroflex USA Inc.; Aerocel.
      b. Armacel LLC; AP Armaflex.
   2. Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
   3. Minimal thermal conductivity at 75° F of 0.25 (Btu.in/hr.ft². F).

I. Mineral-Fiber Blanket Insulation:
   1. Manufacturers:
      a. Johns Manville; Microlite.
      b. Knauf Insulation; Duct Wrap
      c. Owens-Corning; All-Service Duct Wrap.
   2. Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSP jacket. Factory-applied jacket requirements are specified in Part 2 “Factory-Applied jackets” Article.
   3. Minimal density of 1.0 lb/ft³, installed R-value of 6.0 (at 2” thick).

J. Mineral-Fiber Board Insulation:
   1. Manufacturers:
      a. Johns Manville; 800 Series Spin-Glas.
      b. Knauf Insulation; Insulation Board.
      c. Owens Corning; Fiberglas 700 Series.
   2. Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
   3. Minimal density of 2.25 lb/ft³, with a R-value of 8.7 (at 2” thickness).

K. Mineral-Fiber, Preformed Pipe Insulation:
   1. Manufacturers:
      a. Johns Manville; Micro-Lok.
b. Knauf Insulation; 1000° Pipe Insulation.
c. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Minimum thermal conductivity at 75° F of 0.23 (Btu.in/hr.ft². F). Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated. All products are to contain low V.O.C. as defined/governed by LEED IEQ 4.1 and 4.2 (Regardless of project type).

B. Cellular-Glass, One part, acetoxy cure, silicone adhesive, with a service temperature range of minus 50 to plus 400 deg F.
   1. Products:
      a. Foamglas: PC RTV 450 Sillicone Adhesive

C. Flexible Elastomeric: Comply with MIL-A-24179A, Type II, Class I.
   1. Products:
      a. K-Flex: 720 LVOC or equal

D. Phenolic: Water based adhesive with a service temp of minus 20°F to 700°F.
   1. Products:
      a. Foster 97-15

E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. Products:
      a. Design Polymerics, DP2502 (or approved equal).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II. All products are to contain low V.O.C. as defined/governed by LEED IEQ 4.1 and 4.2 (Regardless of project type).

B. Vapor-Barrier Mastic: Water based; suitable for outdoor use on below ambient services, or indoor vapor barrier use.
   1. Products:
      a. Childers Products, Division of ITW; CP-35.
   2. Water-Vapor Permeance: ASTM F 1249, 0.09 perm at 55-mils film thickness.
   3. Service Temperature Range: Minus 20 to plus 190 deg F.
   4. Solids Content: ASTM D 1644, 60 percent by volume and 73 percent by weight.
   6. VOC: 36 g/l
2.5 SEALANTS

A. Joint Sealants:
   1. Joint Sealants for Cellular-Glass Products:
      a. Pittsburgh Corning Corporation; Pittseal 444N.
   2. Joint Sealant for Phenolic Products
      a. Foster 95-50

B. Metal Jacket:
   1. Products:
      a. Foster 95-44 or equal.
      b. Childers Products, Division of ITW; CP-76.

C. Mineral Fiber:
   1. Design Polymerics DP 2502.
   2. Childers Products, Division of ITW; CP-35.

D. PVC Jacket:
   1. Childers Products, Division of ITW; CP-35.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
   2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
   3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 2.2 oz./sq. yd. 10 x 10 strand count per square inch, minimum 4" wide band.
   1. Available Products:
      a. Chil-glas #10.
      b. Charles Harmon and Co. white weaveset.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, 25/50 ASTM-F 84, Class 16354-C; thickness as scheduled; roll stock ready for
shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. **Products:**
   a. Johns Manville; Zeston.
   b. Proto PVC Corporation; LoSmoke.

2. **Color:** White

3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
   
   a. **Shapes:** 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

4. Factory-fabricated tank heads and tank side panels.

**C. Metal Jacket:**

1. **Products:**
   a. Childers Products, Division of ITW; Metal Jacketing Systems.

2. **Aluminum Jacket:** Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.
   
   a. Factory cut and rolled to size.

   b. Finish and thickness are indicated in field-applied jacket schedules.

### 2.9 TAPES

**A. ASJ Tape:** White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.

1. **Width:** 4 inches.
2. **Thickness:** 14.0 mils.
3. **Adhesion:** 73 ounces force/inch in width.
4. **Elongation:** 2 percent.
5. **Tensile Strength:** 55 lbf/inch in width.
6. **Color:** White

**B. FSK Tape:** Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.

1. **Width:** 4 inches.
2. **Thickness:** 13 mils.
3. **Adhesion:** 73 ounces force/inch in width.
4. **Elongation:** 2 percent.
5. **Tensile Strength:** 40 lbf/inch in width.
6. **Color:** Silver

### 2.10 SECUREMENTS

**A. Bands:**

1. **Products:**
   a. Childers Products; Bands.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 316; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch with wing or closed seal.

B. Insulation Pins and Hangers:
1. Cupped-Head, Capacitor-Discharge-Insulated Weld Pins: Zinc-coated steel pin, fully annealed for capacitor-discharge welding, 12 Gauge shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer. Contractor to field verify, integrity of pin weld on ductwork with sheet metal thickness less than 22-gauge. Integrity to be verified prior to concealment with insulation.
   a. Products:
      1) GEMCO; Cupped Head Weld Pin or equal.

2. Metal, “Peel and Press” Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. Products:
      1) GEMCO; Peel and Press or equal.
   b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 12 Gauge diameter shank, length to suit depth of insulation indicated.
   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

3. Insulation-Retaining Washers and Cap: Self-locking cap washers formed from 12 Gauge, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
   a. Products:
      1) AGM Industries, Inc.; RC-150.
      2) GEMCO; R-150.
   b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

2.11 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
   1. Verify that systems and equipment to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application. For Stainless Steel; apply a corrosion coating to insulated surfaces with an epoxy primer and an epoxy finish 5 mils thick.

B. Verify and coordinate insulation installation with the systems and trades installing heat tracing. Comply with requirements for heat tracing that applies to insulation.

3.3 COMMON INSTALLATION REQUIREMENTS

A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

C. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

D. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

E. Install high-density inserts at hanger locations prior to insulating (duct and pipe); wood or block inserts are not acceptable.

F. Install insulation with longitudinal seams at top and bottom of horizontal runs.

G. Where multiple layers of insulation are required, longitudinal and end seams are to be staggered.

H. Do not weld brackets, clips, pins or other attachment devices to piping, fittings, tanks, coils, equipment, vessel, and specialties.
I. Keep insulation materials clean and dry before, during application, and finishing.

J. Install insulation with tight longitudinal seams and end joints.

K. Install insulation with least number of joints practical.

L. Install insulation so that material is not over compressed. Install corner angles prior to insulating; to protect all insulation from damage.

M. Seal all joints, and seams, including penetrations in insulation, at supports, and other projections with insulation of same material overlapped by 2”. Secure strips with outward clinching staples along edge of overlap, (spaced 1 inch on center) and seal entire joint or seam with mastic and embedded fiberglass reinforcing mesh, minimum 4", cover mesh with finish coat of mastic.

N. Do not insulate, conceal, or enclose pipe hangers, channel and steel supports, etc. not directly fasten to duct.

O. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

P. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses. Do not water down products unless directed by manufacture. Use clean potable demineralized water when required.

Q. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

R. Repair all damage insulation prior to concealment as noted above.

S. Do not insulate or conceal vibration-control devices, labels, stamps, nameplates, data plates, manholes, cleanouts, etc. require for maintenances.

T. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarded integrity, unless otherwise indicated.

U. Insulate pipe elbows, tees, valves, strainers, flanges, etc., using preformed fitting insulation, mitered fittings or oversized preformed pipe insulation made from same material thickness and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, voids, and irregular surfaces with insulating mastic finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation. Provide a removable reusable insulation cover; design that maintains vapor barrier. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts.
V. Cover segmented insulated surfaces with a layer of finishing adhesive and coat with a vapor-barrier mastic. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

W. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Secure PVC covers to adjoining insulation facing using staples and ASJ tape. Seal PVC fitting covers with mastic.

X. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating adhesive and finish with mastic. All connections are to be accessible.

Y. Install removable insulation segment and covers at flanges, valves, controls, unions, equipment access doors, manholes, hand holes, and other elements that require frequent removal for service and inspection. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.4 PENETRATIONS

A. Install insulation continuously through all walls, floors, and partitions penetrations and sleeves.

B. Extend jacket of outdoor installation into wall and roof jacks by 2 inches. Seal jacket to roof flashing with approved flashing sealant.

C. Insulation Installation at Fire-Rated Walls, floors and Partitions Penetrations for duct work where fire/smoke dampers are required: Terminate insulation at fire damper sleeves as require by damper manufacturer. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

3.5 GENERAL PIPE INSULATION INSTALLATION (IN ADDITION TO COMMON REQUIREMENTS)

A. Preformed Pipe Insulation Installation on Pipe, Fittings, Valves, Flanges, Tanks, Elbows, and Appurtenances for Cellular- Glass, Mineral- Fiber, Flexible Elastomeric, and Phenolic insulations:
   1. Install insulation in a manner that secures material to system being insulated with staples, tape and mastic.
   2. When insulation with preformed pipe insulation, seal all longitudinal seams, end joints, and protrusions with manufacturers recommended tape matching jacket, vapor-barrier mastic, joint sealant, and adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
3. Secure fittings, jacket, cover, etc. with tape matching jacket and secure with outward clinched staples 1 inch on center. Apply vapor-barrier mastic over staples.

4. Arrange insulation to permit access to valves packing, flanges, unions, etc. and valve operation for maintenance without disturbing insulation. Install insulation so that it can be removed without damage to surrounding insulation or access enclosure.

5. Pipe hangers are not to be concealed in insulation.

6. Seal all exposed insulation ends with mastic.

7. Seal all mitered joints prior to installing covers with vapor-barrier sealant and mastic.

8. Install preformed pipe insulation to outer diameter of pipe flange.

9. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

10. Fill voids between inner circumference of valves, flange, elbows, and bolts insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.

11. Install preformed sections of same material insulation when available. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Install PVC cover over fitting or mitered section.

12. Arrange insulation to permit access to valves packing, flanges, unions, etc. and valve operation for maintenance without disturbing insulation. Install insulation so that it can be removed without damage to surrounding insulation or access enclosure.

3.6 GENERAL BLANKET AND BOARD INSULATION INSTALLATION (IN ADDITION TO COMMON REQUIREMENTS)

A. Blanket and Board Insulation Installation on Duct, Tanks, Vessels, Elbows, and Appurtenances:

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for a minimum of 50 percent coverage of duct and plenum and 100 percent coverage of equipment, tanks, etc.; to secure insulation to surfaces. Apply adhesive to entire circumference of all surfaces; including fittings and transitions.

2. Install cupped-head, capacitor-discharge-weld pins surfaces to secure insulation to ductwork. Install on sides and bottom of horizontal and vertical ducts having a width or height greater than 23 inches. Locate 16 inches center and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface as required by manufacturer recommendation. Use approved adhesive stick anchor pins with washers for all equipment, tanks, etc. Cut excess portion of stick anchor pins and install washer’s caps. Cover exposed pins and washers caps with tape and mastic matching insulation facing.

3. Install PVC corner angles prior to installing blanket insulation.
4. Do not over compress insulation during installation. Cover exposed pins and washers with tape matching insulation facing and mastic.

5. Install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 3/4-inch outward-clinching staples, 1 inch on center. Coat all seams/joints with mastic and embed with fiberglass reinforced mesh, minimum 4", cover mesh with finish coat of mastic.

6. Repair punctures, tears, penetrations and protrusions with 6-inch-wide strips of same material used to insulate duct. Seal all seams with staples, cover with mastic and cover with embedded fiberglass reinforced mesh, cover mesh with finish coat of mastic.

7. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

8. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

9. Insulate hangers attached to duct work. Do not insulate or enclose channel, supports, etc. not directly fasten to duct.

10. Insulation termination: Butt insulation up to termination point. Apply mastic no less than 3" overlap on insulation, and 3" on metal surface. Embed fiberglass reinforced mesh overlapping full 3" of termination point, 6" strip. Cover mesh with finish coat of mastic.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge. Secure metal jacket with stainless-steel bands 12 inches on center and at end joints.

3.8 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 painting Sections.

1. Flat Acrylic Finish: Two (2) finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer’s recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
   1. Inspect insulated duct, pipe, and equipment, randomly selected by Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to two (3) location(s) for each system.
   2. All insulation applications will be considered defective work if sample inspection reveals noncompliance with requirements.
   3. Remove all defective work and install new insulation and jackets to replace insulation and jackets removed for inspection. Repeat inspection procedures as needed.

3.10 INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:
   1. Indoor, concealed/exposed supply, return, relief and outdoor air.
   2. Outdoor, concealed/exposed supply, return and relief air.

B. Piping Requiring Insulation:
   1. Indoor and outdoor hydronics.
   2. All pipe and appurtenances that are susceptible to sweating.
   3. All pipe and appurtenances carrying water or refrigerant, for space conditioning.
   4. Any piping not specifically scheduled for insulation below to be insulated with the code minimum required insulation.

C. Items Not Insulated:
   1. Fibrous-glass ducts.
   2. Double-wall metal ducts or lined metal ducts, both with sufficient insulation thickness to comply with adopted edition of IECC and ASHRAE/IESNA 90.1.
   3. Factory-insulated flexible ducts.
   5. Flexible connectors.
   7. Factory-insulated access panels and doors.
   8. General building exhaust duct.

3.11 DUCT AND PLENUM INSULATION SCHEDULE
A. Indoor, concealed, all duct insulation shall be of the following (Including dishwasher exhaust):
   1. Mineral-Fiber Blanket: 2 inches thick and 1.00-lb/cu. ft. nominal density.

B. Indoor, exposed (including mechanical rooms and utility rooms), all duct insulation shall be of the following:

C. Outdoor (including underfloor), all duct insulation shall be any of the following:
   1. Rectangular Duct: Cellular Glass, 3 inches thick and 7.5-lb/cu. ft. nominal density. (minimum R-value of 8)
   2. Round/Flat Oval: Double wall construction (reference Metal Ducts Specification).

3.12 AIR DEVICE INSULATION SCHEDULE
A. Supply-air devices (all styles/sizes): Field insulate backside of all devices that are not factory lined:
   1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density. Secured to air device with FSK tape, all sides.

3.13 EQUIPMENT INSULATION SCHEDULE
A. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

B. Expansion/compression/buffer tanks, Air-separators, filter feeders, etc. insulation shall be any of the following:
   1. Cellular Glass: 3 inches. (chilled water service)
   2. Phenolic: 2 inches. (chilled water service)
   3. Mineral Fiber Board: 3 inches. (hot water service)

C. Steam-to-hot water heat exchanger insulation:
   1. Mineral-Fiber board: 3” thick, 3lb/cu. ft. density.
   2. Cellular Glass: 3” thick, 7.5 lb/cu. ft density.

3.14 PIPING INSULATION SCHEDULE
A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range.

B. Condensate and Equipment Drains:
   1. All Pipe Sizes: Insulation shall be any of the following:
      a. Flexible Elastomeric: 1 inch thick.

C. Chilled Water Supply and Return:
   1. All Pipe Sizes: Insulation shall be any of the following:
b. Cellular Glass: (for use indoors and outdoors, not accepted in underfloor or buried). Reference schedule below for thickness.
c. Phenolic: (for use indoors and outdoors, not accepted in underfloor or buried). Reference schedule below for thickness.

D. Hot Water Supply and Return:
   1. All pipe sizes:
      c. Phenolic: (for use indoors and outdoors, not accepted in underfloor or buried) Reference Schedule below for thickness.
      d. Cellular Glass: (for use indoors and outdoors, not accepted in underfloor or buried) Reference Schedule below for thickness.

E. Phenolic Density Schedule:
   1. Indoors Concealed: 2.5 lb/ft.³ (Green)
   2. Indoors Exposed: 5 lb/ft.³ (Pink)
   3. Outdoors: 5 lb/ft.³ (Pink)

F. Steam and Steam Condensate, 350˚ F and below:
   1. All pipe sizes:
      a. Mineral-Fiber, Preformed pipe, Type I: 3” thick.

<table>
<thead>
<tr>
<th>Fluid</th>
<th>Insulation Thickness Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≤1.5” Pipe Size</td>
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<tr>
<td></td>
<td>Cellulare Glass</td>
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<tr>
<td>Chilled Water</td>
<td>2”</td>
</tr>
<tr>
<td>Hot Water</td>
<td>2”</td>
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<tr>
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<td>Condensate</td>
<td>N/A</td>
</tr>
<tr>
<td>Refrigerant Suction</td>
<td>N/A</td>
</tr>
</tbody>
</table>
G. Refrigerant Suction and Hot Gas Piping:
   1. All pipe sizes: Insulation shall be the following:

3.15 FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Ducts/Piping exposed in finished indoor areas, outdoors, underfloor and mechanical rooms.
   1. Aluminum, Stucco Embossed: 0.016 inch thick.

C. Indoor hydronic piping fitting or elbows.
   1. PVC: 0.015 inch thick.

END OF SECTION
SECTION 23 09 00
INSTRUMENTATION AND CONTROLS FOR HVAC

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 tying any new control equipment into existing BAS, and HVAC systems and components, including extending control components for existing relocated terminal heating and cooling. Controls contractor shall also generate new controls diagrams and floor plans.
   B. Related Sections include the following:
      1. Section "Meters and Gauges" for measuring equipment that relates to this Section.

1.3 DEFINITIONS
   A. DDC: Direct digital control.
   B. I/O: Input/output.
   C. MS/TP: Master slave/token passing.
   D. PC: Personal computer.
   E. PID: Proportional plus integral plus derivative.
   F. RTD: Resistance temperature detector.

1.4 SYSTEM PERFORMANCE
   A. Comply with the following performance requirements:
      1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
      2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
      3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.

5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.

6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.

7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.

8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
   a. Water Temperature: Plus or minus 1 deg F (0.5 deg C).
   b. Water Flow: Plus or minus 5 percent of full scale.
   c. Water Pressure: Plus or minus 2 percent of full scale.
   d. Space Temperature: Plus or minus 1 deg F (0.5 deg C).
   e. Ducted Air Temperature: Plus or minus 1 deg F (0.5 deg C).
   f. Outside Air Temperature: Plus or minus 2 deg F (1.0 deg C).
   g. Dew Point Temperature: Plus or minus 3 deg F (1.5 deg C).
   h. Temperature Differential: Plus or minus 0.25 deg F (0.15 deg C).
   i. Relative Humidity: Plus or minus 5 percent.
   j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
   k. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
   l. Airflow (Terminal): Plus or minus 10 percent of full scale.
   m. Air Pressure (Space): Plus or minus 0.01-inch wg (2.5 Pa).
   n. Air Pressure (Ducts): Plus or minus 0.1-inch wg (25 Pa).
   o. Carbon Dioxide: Plus or minus 50 ppm.
   p. Electrical: Plus or minus 5 percent of reading.

1.5 SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
   1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
   2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
   3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

B. Specification Compliance Review:
1. Manufacturers and bidders must provide the consulting engineer with a Compliance Review of the Specifications and Addenda’s. The Compliance Review shall be a paragraph-by-paragraph review of the Specifications and schedule with the following information; “C”, “D”, or “E” marked in the margin of the original Specifications and any subsequent Addenda’s. If the manufacturer or bidder does not provide the Compliance Review to the engineer for review, with the submittal, the submittal will be subject to rejection as non-compliant.
   a. “C” Comply with no exceptions.
   b. “D” Comply with deviations. For each and every deviation, provide a numbered footnote with reasons for the proposed deviation and how the intent of the Specification can be satisfied.
   c. “E” Exception, do not comply. For each and every exception, provide a numbered footnote with reasons and possible alternatives. Non-compliance with the specifications is grounds for rejection as unacceptable. A bid from any alternative or listed equipment manufacturer with any number of exceptions will be reason for rejection for non-compliance without further review.
   d. Unless a deviation or exception is specifically noted in the Compliance Review, the manufacturer shall provide full compliance with entire specification. Deviations or exceptions taken in letters or cover letters in a bid document, subsidiary documents, by omission or by contradiction do not release the manufacturer or bidder from being in complete compliance, unless the exception or deviation has been specifically noted in the Compliance Review and approved by the consulting engineer.
   e. Equipment manufacturers or bidders that do not meet the specifications thru the above process will be subject to rejection without further review.

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
   2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
   4. Details of control panel faces, including controls, instruments, and labeling.
   5. Written description of sequence of operation.
   6. Schedule of dampers including size, leakage, and flow characteristics.
   7. Schedule of valves including flow characteristics.
   8. DDC System Hardware:
      a. Wiring diagrams for control units with termination numbers.
      b. Schematic diagrams and floor plans for field sensors and control hardware.
      c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.

10. Controlled Systems:
   a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
   b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
   c. Written description of sequence of operation including schematic diagram.
   d. Points list.

D. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.

E. Software and Firmware Operational Documentation: Include the following:
   1. Software operating and upgrade manuals.
   2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
   3. Device address list.
   4. Printout of software application and graphic screens.
   5. Software license required by and installed for DDC workstations and control systems.

F. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.

G. Qualification Data: For Installer.

H. Field quality-control test reports.

I. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section "Operation and Maintenance Data," include the following:
   1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
   2. Interconnection wiring diagrams with identified and numbered system components and devices.
   4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
   5. Calibration records and list of set points.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components
required for this Project. The installer must have a minimum of five (5) continuous years experience with the manufacturer and have an established service office within 100 miles of the project site.

B. 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.

C. Comply with ASHRAE 135 for DDC system components.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at Project completion.

1.8 COORDINATION

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

B. Coordinate equipment with Section "Fire Alarm" to achieve compatibility with equipment that interfaces with that system.

C. Coordinate supply of electrical branch circuits for control units and operator workstation.

D. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 CONTROL SYSTEM

A. Manufacturers:
1. Siemens

B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

2.3 DDC EQUIPMENT

A. Operator Workstation: One PC-based microcomputer(s) with minimum configuration as follows:
1. Motherboard: With 4 integrated USB 2.0 and 2 USB 3.0 ports, integrated Intel Pro 10/100/1000 (Ethernet), integrated audio, bios, and hardware monitoring.
2. Processor: Intel Quad Core i7 Processor, 3.0 GHz.
3. Random-Access Memory: 8 GB.
5. Monitor: 24 inches, flat panel LCD, color.
8. DVD Read/Write Drive: 48x24x48.
11. Operating System: Microsoft Windows 7 Professional with high-speed Internet access.
   a. ASHRAE 135 Compliance: Workstation shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
12. Application Software:
   a. Graphical User Interface (GUI): Thin client or browser based meeting the following criteria:
      1) Web Browser's for PC's: Only a 5.x browser (Internet Explorer or Netscape Navigator) will be required as the GUI, and a valid connection to the server network. No installation of any custom software shall be required on the operator's GUI workstation/client. Connection shall be over an intranet or the Internet. A firewall shall be installed (as necessary) to protect the owner’s Intranet.
      2) Secure Socket Layers: Communication between the Web Browser GUI and control system server shall be encrypted using 128 bit encryption technology within Secure Socket Layers (SSL). Communication protocol shall be Hyper Text Transfer Protocol (HTTP).
b. Cross Platform Capability: The controls software (client and server) shall be operating system and hardware agnostic, compatible with Microsoft Windows, Sun Microsystems Solaris and Red Hat Linux.

c. Database creation and support with the following:
   1) Database Open Connectivity: The BAS server database shall be Java DataBase Connectivity (JDBC) compatible, allowing real time access of data via the following standard mechanisms:
      a) Common Object Request Broker Architecture (CORBA).
      b) OLE/OPC (for Microsoft Client's/Server platform only).
      c) Import/Export of the database from or to XML (extensible Markup Language).
   2) Automatic and manual database save and restore.

d. System security for each operator via software password and access levels.

e. Automatic system diagnostics; monitor system and report failures.

f. Tree navigation.

g. Dynamic color graphic displays with up to 10 screen displays at once.

h. Custom graphics generation and graphics library of HVAC equipment and symbols.

i. Alarm processing, messages, and reactions.

j. Trend logs retrievable in spreadsheets and database programs.

k. Alarm and event processing.

l. Object and property status and control.

m. Automatic restart of field equipment on restoration of power.

n. Data collection, reports, and logs. Include standard reports for the following:
   1) Current values of all objects.
   2) Current alarm summary.
   3) Disabled objects.
   4) Alarm lockout objects.
   5) Logs.

o. Custom report development.

p. Utility and weather reports.

q. ASHRAE Guideline 3 report.

r. Workstation application editors for controllers and schedules.

s. Maintenance management.

13. Custom Application Software:
   a. English language oriented.
   b. Full-screen character editor/programming environment.
   c. Allow development of independently executing program modules with debugging/simulation capability.
   d. Support conditional statements.
   e. Support floating-point arithmetic with mathematic functions.
   f. Contains predefined time variables.

B. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.

2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
   a. Global communications.
   b. Discrete/digital, analog, and pulse I/O.
   c. Monitoring, controlling, or addressing data points.
   d. Software applications, scheduling, and alarm processing.
   e. Testing and developing control algorithms without disrupting field hardware and controlled environment.

3. Standard Application Programs:
   a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, antishort cycling, PID control, DDC with fine tuning, and trend logging.
   b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
   c. Chiller Control Programs: Control function of condenser-water reset, chilled-water reset, and equipment sequencing.
   d. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
   e. Remote communications.
   f. Maintenance management.
   g. Units of Measure: Inch-pound and SI (metric).

4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.

5. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

C. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.

   1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.

   2. Stand-alone mode control functions operate regardless of network status. Functions include the following:

      a. Global communications.
      b. Discrete/digital, analog, and pulse I/O.
      c. Monitoring, controlling, or addressing data points.

   3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.

   4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

D. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
7. Universal I/Os: Provide software selectable binary or analog outputs.

E. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
   1. Output ripple of 5.0 mV maximum peak to peak.
   2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
   3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

F. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
   1. Minimum dielectric strength of 1000 V.
   3. Minimum transverse-mode noise attenuation of 65 dB.
   4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.4 UNITARY CONTROLLERS

A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
   1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
   2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.
   3. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.
4. Enclosure (interior): Dustproof rated for operation at 32 to 120 deg F (0 to 50 deg C).
5. Enclosure (exterior): NEMA 3R.

2.5 ALARM AND OCCUPANT INTERFACE PANELS

A. Unitized cabinet with suitable brackets for wall or floor mounting. Fabricate of 0.06-inch- (1.5-mm-) thick, furniture-quality steel or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish. Provide common keying for all panels.

B. Alarm Panels: Indicating light for each alarm point, single horn, acknowledge switch, and test switch, mounted on hinged cover.
   1. Alarm Condition: Indicating light flashes and horn sounds.
   2. Acknowledge Switch: Horn is silent and indicating light is steady.
   3. Second Alarm: Horn sounds and indicating light is steady.
   4. Alarm Condition Cleared: System is reset and indicating light is extinguished.
   5. Contacts in alarm panel allow remote monitoring by independent alarm company.

2.6 ANALOG CONTROLLERS

A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.

B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F (minus 23 to plus 21 deg C), and single- or double-pole contacts.

C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
   1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.

D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.

2.7 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
B. Thermistor Temperature Sensors and Transmitters:
   1. Available Manufacturers:
      a. Alerton.
      b. BEC Controls Corporation.
      c. Ebtron, Inc.
      d. Heat-Timer Corporation.
      e. I.T.M. Instruments Inc.
      f. MAMAC Systems, Inc.
   2. Accuracy: Plus or minus 0.5 deg F (0.3 deg C) at calibration point.
   4. Insertion Elements in Ducts: Single point, 8 inches (200 mm) long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (0.84 sq. m). Mount sensor in an electrical box through a hole in the duct, in an easily accessible location.
   5. Averaging Elements in Ducts: 36 inches (915 mm) long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft. (1 sq. m).
   6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches (64 mm).
   7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
      a. Set-Point Adjustment (where indicated): Exposed.
      b. Set-Point Indication (where indicated): Exposed.
      c. Thermometer: Concealed.
      d. Color: Manufacturer’s standard.
   8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

C. RTDs and Transmitters:
   1. Available Manufacturers:
      a. Alerton
      b. Automation Components, Inc. (ACI)
      c. Building Automation Products, Inc. (BAPI)
   2. Accuracy: Plus or minus 0.2 percent at calibration point.
   4. Insertion Elements in Ducts: Single point, with length equal to 1/3-distance of duct width, minimum; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (0.84 sq. m).
   5. Averaging Elements in Ducts: 24 inches (610 mm) long, rigid; use where prone to temperature stratification or where ducts are larger than 9 sq. ft. (0.84 sq. m); length as required.
   6. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches (64 mm).
   7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
      a. Set-Point Adjustment (where indicated): Exposed.
      b. Set-Point Indication (where indicated): Exposed.
      c. Thermometer: Concealed.
d. Color: Manufacturer’s standard.
8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

D. Humidity Sensors: Bulk polymer sensor element.
1. Available Manufacturers:
   a. Alerton.
   b. BEC Controls Corporation.
   c. MAMAC Systems, Inc.
   d. TCS/Basys Controls.
   e. Vaisala.
   f. Veris Industries.
2. Accuracy: 2 percent full range with linear output.
3. Room Sensor Range: 20 to 80 percent relative humidity.
4. Room Sensor Cover Construction: Manufacturer's standard locking covers.
5. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
6. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of 32 to 120 deg F (0 to 50 deg C).
7. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.

E. Pressure Transmitters/Transducers:
1. Available Manufacturers:
   a. BEC Controls Corporation.
   b. MAMAC Systems, Inc.
   c. ROTRONIC Instrument Corp.
   d. TCS/Basys Controls.
   e. Vaisala.
   f. Veris Industries.
2. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
   a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
   b. Output: 4 to 20 mA.
   c. Building Static-Pressure Range: 0- to 0.25-inch wg (0 to 62 Pa).
   d. Duct Static-Pressure Range: 0- to 5-inch wg (0 to 1240 Pa).
3. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig (1034-kPa) operating pressure; linear output 4 to 20 mA.
4. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig (1034-kPa) operating pressure and tested to 300-psig (2070-kPa); linear output 4 to 20 mA.
5. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
6. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; linear output 4 to 20 mA.

2.8 STATUS SENSORS

A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg (0 to 1240 Pa).

B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig (55 to 414 kPa), piped across pump.

C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.

E. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.

F. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements. Manufactured by Veris Industries or equivalent.

G. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

H. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.
   1. Available Manufacturers:
      a. BEC Controls Corporation.
      b. I.T.M. Instruments Inc.
      c. Kele & Associates

2.9 GAS DETECTION EQUIPMENT

A. Manufacturers:
   1. General Monitors.
   2. Veris Industries.
B. Carbon Dioxide Sensor and Transmitter: Single detectors using solid-state, non-dispersive, infrared sensors; suitable over a temperature range of 23 to 130 deg F (minus 5 to plus 55 deg C) and calibrated for 0 to 2 percent, with continuous or averaged reading, 4- to 20-mA output.
   1. Operating Range: 0 to 2,000 ppm.
   2. Exposure Range: 0 to 140 deg F (without damage).
   3. Operating Humidity: 5 to 95% relative humidity.
   4. Repeatability: plus or minus 20 ppm.
   5. Maximum Drift: plus or minus 25 ppm per year.

C. Hydrocarbon Sensors: Model #S4000CH by General Monitors (no exceptions). Provide stainless steel (316) slip-stream sampling accessories (supply/return sampling tubes, sealed sensor housing, mounting plates, hardware, etc) as necessary for duct mounting in a readily accessible location. Provide with all accessories necessary for periodic testing and calibration. Coordinate with mechanical contractor.

D. Hydrogen Sulfide (H2S) Sensors: Model #S4000T by General Monitors (no exceptions). Provide stainless steel (316) slip-stream sampling accessories (supply/return sampling tubes, sealed sensor housing, mounting plates, hardware, etc) as necessary for duct mounting in a readily accessible location. Provide with all accessories necessary for periodic testing and calibration. Coordinate with mechanical contractor.

2.10 AIRFLOW MEASURING STATIONS (AFMS)

A. Duct Airflow Station: Combination of air straightener and multiport, self-averaging pitot tube station.
   1. Manufacturers:
      a. Air Monitor Corporation.
      b. Ruskin.
   2. Model: IAQ50 (Ruskin).
   3. Frame: 6 inches × 1-3/8 inches × minimum 0.125-inch extruded aluminum.
      a. Entire assembly frame shall be flanged.
   4. Blades:
      a. Modulating Air Control:
         1) Style: Airfoil-shaped, single-piece.
         2) Action: Parallel.
         3) Orientation: Horizontal.
         4) Material: Heavy gage 6063-T5 extruded aluminum.
         5) Width: Maximum 5 inches (127 mm).
      b. Stationary Sensing:
         1) Style: Airfoil-shaped, single-piece.
         2) Orientation: Horizontal.
         3) Material: Heavy gage 6063-T5 extruded aluminum.
         4) Width: Maximum 5-1/4 inches (133 mm).
         5) Finish: Anodized.
6. Seals:
7. Linkage: Concealed in frame.
8. Axles: Minimum 1/2 inch (13 mm) diameter plated steel, hex-shaped, mechanically attached to blade.
10. Electric Actuator: 24 V, 60 Hz, modulating, with position feedback.
11. Digital Controller: Application specific controller. Programming logic and calibration in nonvolatile EPROM. Controller uses generic 0 - 10 vdc inputs and outputs for interface to building automation system.
12. Flow Straightener: Aluminum honeycomb, 3/4-inch (20-mm) parallel cell, 3 inches (75 mm) deep, contained in a 5 inch deep sleeve attached to airflow frame.
15. The maximum depth of the assembly shall be no greater than 11 inches. Refer to plans for overall duct dimensions and sizes.
16. Electrical: The airflow station shall run off of 24V power.
17. Performance Data:
   a. Temperature Rating: Withstand -40 to 140 degrees F.
   b. Capacity: Demonstrate capacity of damper/airflow monitor.
      1) Monitor airflow within accuracy of 5 percent.
      2) Perform sensing requirements in HVAC systems with velocities from 300 to 2,000 feet per minute.
   c. Leakage: Maximum 2.0 cubic feet per minute per square foot at 1 inch w.g. for 48 inch × 48 inch closed damper.
      Pressure Drop: Maximum 0.13 inch w.g. at 1,000 feet per minute across both damper/airflow monitor and air straightener.
18. Controls
   a. The AFMS shall come complete with its own controls and, where indicated, a 24V actuator. A 0-10 V DC signal shall be provided by the AFMS to the building EMCS to monitor airflow. The AFMS shall be able to receive a 0-10 V DC signal from the EMCS to act as a setpoint adjustment when an actuator is provided.

2.11 THERMOSTATS

A. Available Manufacturers:
   2. Honeywell
   3. Sauter Controls Corporation.
4. TAC Erie Controls.
5. tekmar Control Systems, Inc.
6. Theben AG - Lumilite Control Technology, Inc.

B. Combination Thermostat and Fan Switches: Line-voltage thermostat with push-button or lever-operated fan switch.
   1. Label switches "FAN ON-OFF," "FAN HIGH-LOW-OFF" or "FAN HIGH-MED-LOW-OFF," as indicated.
   2. Mount on single electric switch box.

C. Electric, solid-state, microcomputer-based room thermostat with remote sensor.
   1. Automatic switching from heating to cooling.
   2. Preferential rate control to minimize overshoot and deviation from set point.
   3. Set up for four separate temperatures per day.
   4. Instant override of set point for continuous or timed period from 1 hour to 31 days.
   5. Short-cycle protection.
   6. Programming based on weekday, Saturday, and Sunday.
   7. Selection features include degree F or degree C display, 12- or 24-hour clock, keyboard disable, remote sensor, and fan on-auto.
   8. Battery replacement without program loss.
   9. Thermostat display features include the following:
      a. Time of day.
      b. Actual room temperature.
      c. Programmed temperature.
      d. Programmed time.
      e. Duration of timed override.
      f. Day of week.
      g. System mode indications include "heating," "off," "fan auto," and "fan on."

D. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F (13 to 30 deg C) set-point range, and 2 deg F (1 deg C) maximum differential.

E. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F (13 to 30 deg C) set-point range, and 2 deg F (1 deg C) maximum differential.
   1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.

F. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, automatic-reset switch that trips if temperature sensed across any 12 inches (300 mm) of bulb length is equal to or below set point.
1. Bulb Length: Minimum 20 feet (6 m).
2. Quantity: One thermostat for every 20 sq. ft. (2 sq. m) of coil surface.

G. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, automatic-reset switch that trips if temperature sensed across any 12 inches (300 mm) of bulb length is equal to or above set point.
1. Bulb Length: Minimum 20 feet (6 m).
2. Quantity: One thermostat for every 20 sq. ft. (2 sq. m) of coil surface.

2.12 HUMIDISTATS

A. Available Manufacturers:
   1. MAMAC Systems, Inc.
   2. ROTRONIC Instrument Corp.

B. Duct-Mounting Humidistats: Electric insertion, 2-position type with adjustable, 2 percent throttling range, 20 to 80 percent operating range, and single- or double-pole contacts.

2.13 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
   1. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
   2. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
   3. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
   1. Manufacturers:
      a. Belimo Aircontrols (USA), Inc.
   2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
   3. Dampers: Size for running torque calculated as follows:
      a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. (86.8 kg-cm/sq. m) of damper.
      b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. (62 kg-cm/sq. m) of damper.
      c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft (49.6 kg-cm/sq. m) of damper.
d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. (37.2 kg-cm/sq. m) of damper.
e. Dampers with 2- to 3-Inch wg (500 to 750 Pa) of Pressure Drop or Face Velocities of 1000 to 2500 fpm (5 to 13 m/s): Increase running torque by 1.5.
f. Dampers with 3- to 4-Inch wg (750 to 1000 Pa) of Pressure Drop or Face Velocities of 2500 to 3000 fpm (13 to 15 m/s): Increase running torque by 2.0.

5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
7. Power Requirements (Two-Position Spring Return): 24-V ac.
8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
10. Temperature Rating: Minus 22 to plus 122 deg F (Minus 30 to plus 50 deg C).
11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F (Minus 30 to plus 121 deg C).
12. Run Time: 12 seconds open, 5 seconds closed.

2.14 CONTROL VALVES

A. Manufacturers:
1. Belimo
2. Parker Hannifin Corporation; Skinner Valve Division.

B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

C. Hydronic system globe valves shall have the following characteristics:
1. NPS 2 (DN 50) and Smaller: Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
2. NPS 2-1/2 (DN 65) and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.
   a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
   b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.
4. Sizing: 5-psig (35-kPa) maximum pressure drop at design flow rate or the following:
b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.

c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.

5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.

D. Butterfly Valves: 200-psig (1380-kPa), 150-psig (1034-kPa) maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
2. Disc Type: Nickel-plated ductile iron.
3. Sizing: 1-psig (7-kPa) maximum pressure drop at design flow rate.

E. Terminal Unit Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
1. Rating: Class 125 for service at 125 psig (860 kPa) and 250 deg F (121 deg C) operating conditions.
2. Sizing: 3-psig (21-kPa) maximum pressure drop at design flow rate, to close against pump shutoff head.
3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

2.15 CONTROL CABLE

A. Electronic and fiber-optic cables for control wiring are specified in Section "Control/Signal Transmission Media."
1. All cable shall be return-air plenum rated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that power supply is available to control units and operator workstation.

B. Verify that duct-, pipe-, and equipment-mounted devices are installed before proceeding with installation.
3.2 INSTALLATION

A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

C. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices at elevations indicated on architectural drawings or 48 inches (1220 mm) above the finished floor where requirements are not indicated.
   1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

D. Install guards on thermostats in the following locations:
   1. Entrances.
   2. Public areas.
   3. Where indicated.

E. Install automatic dampers according to Section "Duct Accessories."

F. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

G. Install hydronic instrument wells, valves, and other accessories according to Section "Hydronic Piping."

H. Install refrigerant instrument wells, valves, and other accessories according to Section "Refrigerant Piping."

I. Install duct volume-control dampers according to mechanical specification sections specifying air ducts.

J. Install electronic and fiber-optic cables according to Section "Control/Signal Transmission Media."

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Section "Raceway and Boxes."
   1. Interior raceway shall be EMT with steel set-screw fittings. Final 18 inches (441 mm) of raceway to equipment and sensors (not junction boxes or control enclosures/panels) is permitted to be 1/2-inch flexible metallic conduit.
   2. Exterior raceway shall be intermediate metallic conduit with compression fittings, unless indicated otherwise. Where roofing supports are required, refer to Division 07 Sections and other roofing drawings specific requirements. Final 24 inches (610 mm) of raceway to equipment and sensors (not junction boxes or control enclosures/panels) is permitted to be liquid-tight flexible non-metallic
Conduit with compression fittings; associated elbows shall be LFNC compression water-tight fittings. LB’s are not acceptable.

B. Install building wire and cable according to Section "Conductors and Cables."

C. Install signal and communication cable according to Section "Control/Signal Transmission Media."
   1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed. Route concealed cable parallel to building lines on j-hooks, bundled.
   2. Install exposed (open ceilings, occupied areas) cable in raceway.
   3. Install permanently concealed wall and partition cable in raceway with a radius bend and nylon bushing termination at an accessible location above ceiling.
   4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
   5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
   6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
   7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
   1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
   2. Test and adjust controls and safeties.
   3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
   4. Test each point through its full operating range to verify that safety and operating control set points are as required.
   5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
   6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

C. DDC Verification:
1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check installation of air supply for each instrument.
6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
8. Check temperature instruments and material and length of sensing elements.
9. Check control valves. Verify that they are in correct direction.
10. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
11. Check DDC system as follows:
   a. Verify that DDC controller power supply is from emergency power supply, if applicable.
   b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
   c. Verify that spare I/O capacity has been provided.
   d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 ADJUSTING

A. Calibrating and Adjusting:
1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer’s written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:
   a. Check analog inputs at 0, 50, and 100 percent of span.
   b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
   c. Check digital inputs using jumper wire.
   d. Check digital outputs using ohmmeter to test for contact making or breaking.
   e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
5. Flow:
a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
b. Manually operate flow switches to verify that they make or break contact.
6. Pressure:
a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
7. Temperature:
a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
b. Calibrate temperature switches to make or break contacts.
8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Section "Demonstration and Training."

END OF SECTION
SECTION 23 31 13
METAL DUCTS

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. Single-wall rectangular ducts and fittings.
2. Double-wall rectangular ducts and fittings.
4. Double-wall round and flat-oval ducts and fittings.
5. Sheet metal materials.
6. Duct liner.
7. Sealants and gaskets.
8. Hangers and supports.
10. Ductwork Cleaning

B. Related Sections:
1. Mechanical Specification Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing requirements for metal ducts.
2. Mechanical Specification Section "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.
3. Mechanical Specification Section “Hangers & Supports”.
4. Mechanical Specification Section “Basic Mechanical Materials and Methods”.
5. Mechanical Specification Section “Special Conditions for Mechanical Work”.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated.

1. Static-Pressure Classes: Variable Volume Systems
   a. Supply Ducts: (Upstream from Air Terminal Units): 3-inch wg.
   b. Supply Ducts (Downstream from Air Terminal Units): 1-inch wg.
d. Outside Air Ducts (Negative Pressure): 1-inch wg.

2. Static-Pressure Classes: Constant Volume Systems
   a. Supply Ducts: 2-inch wg.
   c. Outside Air Ducts (Negative Pressure): 1-inch wg.

3. Static-Pressure Classes: Other Systems
   b. General Exhaust (Negative Pressure): 1-inch wg.
   c. Relief Air: 1-inch wg.

4. Leakage Class:
   a. Round Supply-Air Duct: 3 cfm/100 sq. ft. at static pressure class.
   b. Flat-Oval Supply-Air Duct: 3 cfm/100 sq. ft. at static pressure class.
   c. Rectangular Supply-Air Duct: 6 cfm/100 sq. ft. at static pressure class.
   d. Flexible Supply-Air Duct: 6 cfm/100 sq. ft. at static pressure class.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1.4 DEFINITIONS

A. Exposed: Open to view; not concealed by a ceiling.
   1. Includes mechanical rooms.
   2. Includes outdoors.
   3. Includes crawlspace.

B. Concealed: Covered or Concealed by a ceiling, solid inaccessible or lay-in acoustical tile.

1.5 SUBMITTALS

A. Product Data: For each type of the following products:
   1. Liners and adhesives.
   2. Sealants and gaskets.
   3. Insulation.
   4. Metal.
   5. Fasteners.
   6. Hangers.
   7. Double Wall Ductwork (Round or Flat Oval).
   8. Single Wall (Round or Flat Oval).

B. Shop Drawings/Coordination Drawings: CADD generated, ¼” scale. Show fabrication and installation details for metal ducts.
   1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
   2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, and vibration isolation (where applicable).
13. Ceiling suspension assembly members.
14. Other systems installed in same space as ducts, including fire sprinkler piping; electrical conduits; cable trays; hydronic, domestic, and sanitary piping; and structural members.
15. Ceiling-and-wall-mounting access doors and panels required to provide access to dampers and other operating devices.
16. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

C. Welding certificates.
D. Field quality-control reports.
E. Field Pressure test Reports.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth)
Joints," for static-pressure class, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Seal all duct transverse joints, longitudinal seams, flanges, and duct wall penetrations (SMACNA Seal Class-A regardless of static pressure construction class).

2.2 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. 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:
   1. McGill Airflow LLC.

B. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

F. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
   1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
   2. Thickness:
a. 1 inch, minimum for INDOOR, exposed ducts in conditioned spaces.
b. 1-1/2 inches, minimum for INDOOR ducts in unconditioned spaces, including, but not limited to return-air plenums and mechanical rooms.
c. 2-1/2 inches, minimum for OUTDOOR ducts.
3. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
4. Coat insulation with antimicrobial coating.

G. Formed-on Transverse Joints (Flanges): Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Traverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

H. Seal all duct transverse joints, longitudinal seams, flanges and duct wall penetrations (SMACNA Seal Class-A regardless of static pressure construction class).

2.3 SINGLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Spiral seams complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class. Longitudinal seams (snap-lock) are not acceptable for any application.
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. Lindab Inc.
   b. McGill AirFlow LLC.
   c. SEMCO Incorporated.
   d. Spiral Pipe of Texas

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter (diameter of the round sides connecting the flat portions of the duct).

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

D. Seams: Fabricate according to the spiral seam requirements of SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Longitudinal seams (snap-lock) are not acceptable for any application, except where indicated below.
1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

F. Seal all duct transverse joints, longitudinal seams, flanges and duct wall penetrations (SMACNA Seal Class-A regardless of static pressure construction class).

2.4 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. 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:

1. Lindab Inc.
2. McGill AirFlow LLC.
3. SEMCO Incorporated.
4. Spiral Pipe of Texas

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter (diameter of the round sides connecting the flat portions of the duct) of the inner duct.

C. Outer Duct Fabrication Requirements: Spiral seams complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class. Longitudinal seams (snap-lock) are not acceptable for any application.

1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

2. Seams: Fabricate according to the spiral seam requirements of SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

Longitudinal seams (snap-lock) are not acceptable for any application, except where indicated below.

a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch-diameter perforations, with overall open area of 23 percent.

E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
   1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
   2. Thickness:
      a. 1 inch, minimum for INDOOR, exposed ducts in conditioned spaces.
      b. 1-1/2 inches, minimum for INDOOR ducts in unconditioned spaces, including, but not limited to return-air plenums and mechanical rooms.
      c. 2-1/2 inches, minimum for OUTDOOR ducts.
   3. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
   4. Coat insulation with antimicrobial coating.
   5. Cover insulation with polyester film complying with UL 181, Class 1.

2.5 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, rust, stains, discolorations, and other imperfections. All ductwork shall be a minimum of 24 gage, with a minimum thickness of 0.023 inches. Where in the SMACNA "HVAC Duct Construction Standards-Metal Flexible" it is indicated that a lighter gage to a minimum of 24 gage.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G60 (Z180).
   2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G60 (Z180).
   2. Minimum Thickness for Factory-Applied PVC Coating: 4 mils thick on sheet metal surface of ducts and fittings exposed to corrosive conditions, and minimum 4 mils thick on opposite surface.
3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.

D. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

E. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

F. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

G. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
   1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

H. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

I. Plastic Connectors are not acceptable.

2.6 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CertainTeed Corporation; Insulation Group.
      b. Johns Manville.
      c. Knauf Insulation.
      d. Owens Corning.
      e. Maximum Thermal Conductivity:
         1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
         2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
   2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
   3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916. Equal to DP 2502.

B. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer. Equal to CS-10.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

3. Butt transverse joints without gaps, and coat joint with adhesive.

4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.

6. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

7. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

   a. Fan discharges.

   b. Intervals of lined duct preceding unlined duct.

   c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

8. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.7 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL. All products are to contain low V.O.C. as defined/governed by LEED IEQ 4.1 and 4.2 (Regardless of project type).

B. Water-Based Joint and Seam Sealant (for indoor installation):

1. Application Method: Brush on.

2. Solids Content: Minimum 68 percent.

3. Water resistant.

4. Mold and mildew resistant.
5. VOC: less than 30 g/l (less water).
6. Maximum Static-Pressure Class: 15-inch wg, positive and negative.
7. Service: Indoor.
8. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
9. DP 1020 or approved equal.

C. Water-Based Joint and Seam Sealant (for outdoor installation):
1. Application Method: Tube application or dry tooling.
3. Water resistant.
4. Mold and mildew resistant.
5. Service: Indoor.
6. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
7. Sonolastic NP-1 or approved equal.

D. Flanged Joint Sealant: Comply with ASTM E-84.
1. General: Butyl gasket tape.
2. Type: Butyl Rubber.
3. Service Temperature: Minus 40°F to 245°F
4. Pressure Class: All
5. DP 1040

2.8 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

E. Trapeze and Riser Supports:
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.
PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. All ductwork sizes indicated on drawings are internal, free area dimensions. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

C. Install round and flat-oval ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

H. Coordinate layout with suspended ceiling, fire-and smoke-control dampers, lighting layouts, and similar finished work.

I. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws. Sealant of seems/joints to include (but not limited to): all joints (including gasketed joints) metal seams, taps, any connections, etc.

J. Paint interiors of metal ducts that do not have duct liner, for 24 inches (600 mm) upstream of return air registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 9 painting Sections.

K. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

L. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness. Compression of insulation by other trades (pipe, conduit, etc) is not acceptable.

M. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
N. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

O. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Mechanical Specification Section "Air Duct Accessories" for fire and smoke dampers.

P. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

Q. Horizontal ductwork in mechanical rooms must be installed a minimum of 8’-0” AFF.

R. All duct floor penetrations must have a water-tight, continuous concrete curb surrounding them. Minimum curb size shall be 3-1/2” tall X 3-1/2” wide.

3.2 DUCTWORK HANDLING AND PLENUM PROTECTION

A. All ductwork shall be delivered to site and stored with all openings protected from the elements. Protection to include 2.5 mil thick polyethylene plastic film secured with tape or integral elastic band.

B. Each segment/section of ductwork installed is to be appropriately protected from elements.

C. Any ductwork damaged during delivery, installation, or at any time during construction will be removed from job and replaced.

D. Ductwork found onsite (installed or stored) without approved protection will be removed from job and replaced.

E. Ductwork installed exposed to the elements to be sealed (joints and seems) immediately after installation. Any ductwork not sealed is susceptible to rejection and removed from job.

F. Under no circumstances shall insulation be applied to ductwork prior to the building being fully dried in (i.e.: building sealed, windows and roof installed, etc). Any ductwork being insulated prior to building dry-in is susceptible to rejections and removed from job.

G. If ductwork is found onsite not protected or the newly installed ductwork is deemed as dirty, engineer can elect for the contractor to clean all duct at no cost to the owner per NADCA 1992.

3.3 SEAM AND JOINT SEALINGS
A. Seal all duct transverse joints, longitudinal seams, flanges and duct wall penetrations (SMACNA Seal Class-A regardless of static pressure construction class).

3.4 HANGERS AND SUPPORT INSTALLATION

A. Comply with SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible,” Chapter 4 “Hangers and Supports,” unless otherwise indicated.
1. Support rectangular ducts greater than 36 inches with width with trapeze threaded rod and angle or channel supports. Straps not acceptable.
2. Rectangular Duct Hangers Exposed to View: Threaded rod and channel supports (do not use steel angles).

B. Building Attachments: Concrete inserts or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
1. Where practical, install concrete inserts before placing concrete.

C. Hanger Spacing: Comply with SMACNA’s “HVAC Duct Construction Standards-Metal and Flexible,” Table4-1 (Table 4-1M), “Rectangular Duct Hangers Minimum Size,” and Table 4-2, “Minimum Hanger Sizes for Round Duct,” for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection. Elbows 36” and larger to be individually supported.

D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16’ feet.

E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Do not attach hangers to metal deck roof assemblies with built-up insulation only (no concrete). Attach only to structural steel members.

F. Support vertical ducts at maximum intervals of 16 feet and at each floor.

3.5 CONNECTIONS

A. Make all connections to all fan-bearing equipment with flexible connectors complying with Specification Section “Air Duct Accessories”.

B. Comply with SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible” for branch, outlet and inlet, and terminal unit connections. Reference detail for specific additional items required.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible
galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:
   1. Comply with SMACNA’s “HVAC Air Duct Leakage Test Manual.” Leakage Class defined in previous sections of specification. Amount of ductwork to be tested to be determined by Engineer or Field Inspector).
   2. Test the following systems:
      a. Medium Pressure Ductwork (3-Inch wg), up to Air Terminal (branch taps included): Test representative duct sections totaling no less than 100 percent of total installed duct area.
      b. Low Pressure Supply Ducts: Test representative duct totaling no less than 20 percent of total installed duct area.
      c. Return Ducts: Test representative duct sections totaling no less than 20 percent of total installed duct area.
      d. Exhaust Ducts: Test representative duct sections totaling no less than 20 percent of total installed duct area.
      e. Outdoor Air Ducts: Test representative duct sections totaling no less than 20 percent of total installed duct area.
      f. Grease Laden/Dishwasher Exhaust: Test representative duct sections per IMC “Light Test.”

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

4. Test for leaks before insulation application.

C. Duct system will be considered defective if it does not pass tests and inspections.

D. Contractor to disassemble, reassemble and seal segments of systems to accommodate leakage testing and for compliance with test requirements / leakage rates.

E. All testing equipment to be calibrated (by manufacturer) within 3 years of onsite duct pressure testing. Documentation to be provided for verification of certification to Engineer through submittal process.

F. Test Coupons: Cut out three (3) 4x4" test coupons in random locations selected by the design engineer for verification of gage thickness. Coupons shall be taken at the time of pressure testing.

G. Prepare test and inspection reports.

3.8 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as follows:
   1. Acid-Resistant (Fume-Handling) Ducts:
a. Type 304, stainless-steel sheet – welded.
b. Exposed to View: No. 4 finish.
c. Concealed: No. 2D finish.
3. Spaces with pools, spas, hot tubs or water features: Aluminum.

B. Intermediate Reinforcement:
2. Stainless-Steel Ducts: Galvanized steel.
3. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.

C. Liner:
1. Transfer Ducts: Fibrous glass, Type I 1 inch thick.

D. Double-Wall Duct Schedule:
1. All exposed Round/Flat Oval Ductwork.

E. Elbow Configuration:
1. Rectangular Duct: Comply with SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible,” Figure 2-2, “Rectangular Elbows”.
   a. Velocity 1000 fpm or Lower:
      1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      2) Mitered Type RE 4 without vanes.
   b. Velocity 1000 to 1500 fpm:
      1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible,” Figure 2-3, “Vanes and Vane Runners,” and Figure 2-4, “Vane Support Elbows.”
   c. Velocity 1500 fpm (7.6 m/s) or Higher:
      1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible,” Figure 2-3, “Vanes and Vane Runners,” and Figure 2-4, “Vane Support in Elbows.”
2. Round Duct: Comply with SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible,” Figure 3-3, “Round Duct Elbows”.
   a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible,” Table 3-1, “Mitered Elbows.” Elbows with less than 90-degree change of direction have proportionately fewer segments.
1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or higher: 1.5 radius-to-diameter and five segments for 90-degree elbow.

b. Round Elbows, 12 inches and smaller diameter: Stamped or pleated.
c. Round Elbows, 14 inches and larger in diameter: Welded.

F. Branch Configuration
1. Rectangular Duct: Comply with SMACNA’s “HVAC Duct Construction Standards-Metal and Flexible,” Figure 2-6, “Branch Connections.”
   a. Rectangular Main to Rectangular Branch: 45-degree entry.
   b. Rectangular Main to Round Branch: Side takeoff fitting.
2. Round and Flat Oval: Comply with SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible,” Figure 3-4, “90 Degree Tees and Laterals,” and Figure 3-5, “Conical Tees.” Saddle taps are permitted in existing duct.
   a. Velocity 1000 fpm or Lower: 90-degree tap.
   b. Velocity 1000 to 1500 fpm: Conical tap.
   c. Velocity 1500 fpm or higher: 45-degree lateral.

3.9 CLEANING NEW SYSTEMS

A. If ductwork is found onsite not protected or the newly installed ductwork is deemed as dirty, engineer can elect for the contractor to clean all duct at no cost to the owner per NADCA 1992.

B. System Cleaning: (If required)
1. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.
2. Provide service openings (approved duct access doors), as required, for physical and mechanical entry during cleaning and for inspection. All duct access doors to be installed prior to any duct pressure tests.
   a. Removed and reinstall ceiling sections to gain access during the cleaning process.
3. Vent vacuuming system to the outside. Include filtration to collection debris removed from HVAC systems, and locate exhaust down wind and minimum of 20 feet away from air intakes and other points of entry into building.
4. Clean the following metal duct systems by removing surface contaminants and deposits:
   a. Air outlets and inlets (registers, grilles and diffusers).
   b. Supply, return and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers and drive assemblies.
   c. Air-handling unit internal surfaces and components including mixing box, coil section, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
d. Coils and related components.
e. Return-air ducts, dampers and actuators except in ceiling plenums and mechanical equipment rooms.
f. Supply-air ducts, dampers, actuators and turning vanes.

5. Mechanical Cleaning Methodology:
a. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
b. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
c. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner or duct accessories.
d. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do no permit duct liner to get wet.
e. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

6. Cleanliness Verification:
a. Visually inspect metal ducts for contaminants.
b. Where contaminants are discovered, re-clean and re-inspect ducts.

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Backdraft dampers.
3. Fire dampers
4. Fire and smoke dampers.
5. Turning vanes.
6. Duct-mounted access doors and panels.
7. Flexible ducts.
8. Flexible connectors.
10. Duct accessory hardware.
11. Motorized control dampers.

B. Related Sections include the following:
2. Specification Section "Louvers and Vents" for intake and relief louvers and vents connected to ducts and installed in exterior walls.
3. Specification Section "Air Terminals" for constant-volume and variable-air-volume control boxes, and reheat boxes.
4. Specification Section "Air Inlets and Outlets."
5. Specification Section "HVAC Controls" for electric damper actuators.

1.3 SUBMITTALS

A. Product Data: For the following:
1. Backdraft dampers.
3. Fire dampers.
4. Fire and smoke dampers.
5. Duct-mounted access doors and panels.
6. Flexible ducts.
7. Motorized control dampers.
8. Side takeoff fittings

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Comply with the following NFPA standards:
   1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
   2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
   1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

B. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT DAMPERS

A. Description: Suitable for horizontal or vertical installations.

B. Frame: 0.063-inch thick extruded aluminum, with mounting flange.

C. Blades: 0.050-inch thick aluminum sheet.

D. Blade Seals: Felt.

E. Blade Axles: Nonferrous.

F. Tie Bars and Brackets: Aluminum.

G. Return Spring: Adjustable tension.

2.3 MANUAL-VOLUME DAMPERS
A. General: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
   1. Pressure Classifications of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

B. Standard Volume Dampers: Multiple- or single-blade, opposed-blade design, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
   1. Roll-Formed Steel Blades: 0.064-inch thick, galvanized, sheet steel.
   3. Tie Bars and Brackets: Galvanized steel.
   4. 1-1/2-inch insulation buildout with locking quadrant.

C. Low-Leakage Volume Dampers: Multiple- or single-blade, opposed-blade design, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
   1. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
   2. Roll-Formed Steel Blades: 0.064-inch thick, galvanized, sheet steel.
   5. Tie Bars and Brackets: Galvanized steel.
   6. 1-1/2-inch insulation buildout with locking quadrant.

D. Jackshaft: 1-inch diameter, galvanized steel pipe rotating within a pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
   1. Length and Number of Mountings: Appropriate to connect linkage of each damper of a multiple-damper assembly.

E. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.4 FIRE DAMPERS

A. General: Labeled to UL 555 (sixth edition). Ruskin Model D1BD2-B (or design engineer approved equivalent). Dampers shall be marked with a UL-Classified fire protection rating and marked “For Use in Dynamic Systems”.

B. Fire Rating: One and one-half and/or three hours as indicated.
C. Frame: SMACNA Type B with blades out of airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

D. Mounting Sleeve: Provide factory-mounted sleeve and retaining angles.
   I. Minimum Thickness (Sleeve shall not extend more than 6\" past wall or floor without factory installed access door): 16 gauge and length to suit application.

E. Mounting Orientation: Vertical or horizontal as indicated.

F. Blades: Roll-formed, interlocking, 0.034-inch thick, galvanized, sheet steel. In place of interlocking blades, use full-length, 0.034-inch thick, galvanized steel blade connectors.

G. Horizontal Dampers: Include a blade lock and stainless-steel negator closure spring.

H. Fusible Link: Replaceable, 165 deg F rated as indicated.

2.5 COMBINATION FIRE / SMOKE DAMPERS (SFD)

A. General: Labeled to UL 555/UL 555S (sixth and fourth edition respectively) Combination fire and smoke dampers shall be labeled for one-and-one-half-hour rating to UL 555S. Provide Class II leakage rating. Dampers shall be marked with a UL-classified fire rating. Ruskin FSD-60 or approved equivalent. The SFD shall be listed to operate from the fire alarm control panel (FACP). Each SFD shall have an associated smoke detector that shall be addressable from the FACP. The smoke detector shall be provided by the Fire Alarm Contractor and installed by the Electrical Contractor. Coordinate damper installation with these trades.

B. Electric Fusible Link (EFL): 165 or 212 deg F rated as applicable.

C. Frame and Blades: 16 gauge, galvanized, sheet steel. Damper blades shall be airfoil-shaped, single-piece construction, with blade seals mechanically locked into blade edge (adhesive clip-on seals are not acceptable). Ruskin FSD-60 or equivalent. Damper blades shall be minimum 14 gauge. SFD’s installed off vertical chases shall have vertical airfoil blades (Ruskin FSD 60-V or equivalent).

D. Mounting Sleeve: Factory-installed, 16 gauge, galvanized, sheet steel; length to suit wall or floor application. Sleeve shall not extend more than 6\" past wall or floor without factory installed access door. SFD shall be capable of mounting on either side of wall and working with airflow in either direction. Provide manufacturer-recommended duct-to-sleeve joints.

E. Electric controlled closure is not less than 7 seconds or more than 10 seconds to prevent HVAC and duct damage. Damper shall have local reset button and shall have automatic reset after test, smoke detection or power failure conditions. Damper shall close upon loss of power or AHU shut down. Actuator shall be 120V.

F. Provide with stainless steel jam seals and bearings. (Bronze bearings are not acceptable)
G. Furnish and install dampers according to manufacturer’s instructions and in compliance with the latest edition of the SMACNA Duct Manual and NFPA Standards (90, 92A, and 92B).

2.6 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Manufactured Turning Vanes: Fabricate of 1-1/2-inch wide, curved blades set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into side strips suitable for mounting in ducts.

2.7 DUCT-MOUNTED ACCESS DOORS AND PANELS

A. Provide where indicated on drawings low leakage spin-in access doors for sheet metal applications. Flexmaster Inspector series.

B. The outer frame shall be constructed of a single piece of 24-gauge G90 galvanized steel roll formed and notched for spin-in applications. The entry side shall be roll formed and double hemmed for safe entry and exit.

C. The inner door shall be constructed of a 24-gauge draw quality steel, filled with a 1-inch thick polystyrene insulation and held in place by a galvanized steel backplate (stainless steel backplate may be substituted as required).

D. A continuous .375-inch wide by .1875-inch thick open cell adhesive neoprene gasket shall be installed in the door frame to provide a positive seal upon insertion and locking of the door.

E. The door shall be held secure with evenly spaced cast aluminum cam latches for even pressure against the gasket.

2.8 FLEXIBLE CONNECTORS

A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

B. Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 2-3/4-inch wide, 0.028-inch thick, galvanized, sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected ducts.

   1. Minimum Weight: 26 oz./sq. yd.
   2. Tensile Strength: 480 lbf/inch in the warp, and 360 lbf/inch in the filling.
D. Conventional, Outdoor System Flexible Connector Fabric: Glass fabric double coated with a synthetic-rubber, weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.
   1. Minimum Weight: 26 oz./sq. yd.
   2. Tensile Strength: 530 lbf/inch in the warp, and 440 lbf/inch in the filling.

2.9 INSULATED FLEXIBLE DUCT, LOW PRESSURE

A. Flexmaster type 1M UL181 Class I Air Duct. (No exceptions)

B. The duct shall be constructed of a PE fabric supported by helical wound galvanized steel. The fabric shall be mechanically locked to the steel helix without the use of adhesives or chemicals.

C. The internal working pressure rating shall be at least 6" w.g. positive and 4" w.g. negative, with a bursting pressure of at least 2-1/2 times the working pressure.

D. The duct shall be rated for a velocity of at least 4000 feet per minute.

E. The duct must be suitable for continuous operation at a temperature range of -20 deg F to +250 deg F.

F. Acoustical performance, when tested by an independent laboratory in accordance with the Air Diffusion Council’s Flexible Air Duct Test Code FD 72-R1, Section 3.0, Sound Properties, shall be as follows:
   1. The insertion loss (dB) of a 6-foot length of straight duct when tested in accordance with ASTM E 477, at a velocity of 500 feet per minute, shall be at least:

<table>
<thead>
<tr>
<th>Octave Band</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hz.</td>
<td>125</td>
<td>250</td>
<td>500</td>
<td>1000</td>
<td>2000</td>
<td>4000</td>
</tr>
<tr>
<td>8” diameter</td>
<td>5.6</td>
<td>10.6</td>
<td>23.9</td>
<td>34.0</td>
<td>22.5</td>
<td>17.0</td>
</tr>
<tr>
<td>10” diameter</td>
<td>4.4</td>
<td>27.7</td>
<td>25.7</td>
<td>32.0</td>
<td>21.3</td>
<td>12.4</td>
</tr>
<tr>
<td>12” diameter</td>
<td>6.6</td>
<td>27.8</td>
<td>22.8</td>
<td>29.0</td>
<td>18.7</td>
<td>10.9</td>
</tr>
</tbody>
</table>

G. Factory insulate the flexible duct with fiberglass insulation. The R-value shall be at least 6 at a mean temperature of 75 deg F.

H. Cover the insulation with a fire retardant metalized vapor barrier jacket reinforced with crosshatched scrim (FSK) having a permeance of not greater than 0.05 perms when tested in accordance with ASTM E 96, Procedure A.

2.10 SIDE TAKEOFF FITTINGS
A. Provide Flexmaster Model STOD or SBMD takeoff for sheet metal for all taps connecting to flex duct, except for air devices with OBD’s and flow bar. For devices with OBD, use Flexmaster Model STO- or SBM no exceptions.

B. The side takeoff fittings shall maintain a ratio of 1:1 of inlet to outlet on all units over 7-inch diameter to allow proper sizing of the duct system.

C. Model STOD side takeoff shall have a 1-inch offset rear edge for enhanced pressure drop characteristics and 1-1/2-inch insulation buildout with locking hand quadrant.

D. Fittings shall have a 1-inch-wide prepunched mounting flange with corner clips and adhesive gasket for minimal leakage and ease of installation.

E. The fittings shall be constructed of a two-piece 26-gauge G-90 galvanized steel body and collar.

F. The overall length of the fitting shall be 13 inches with or without damper to reduce turbulence in the airstream.

G. The round outlet shall be provided with a rolled stiffener bead for strength and ease of installation and sealing of spiral and flexible ductwork joints.

2.11 ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments, and length to suit duct insulation thickness.

B. Splitter Damper Accessories: Zinc-plated damper blade bracket; 1/4-inch, zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.

C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches to suit duct size.

D. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.12 MOTORIZED CONTROL DAMPERS

A. Manufacturers:
   1. Greenheck.
   2. Nailor Industries Inc.
   3. Ruskin Company.
   4. Potterff.

B. General Description: AMCA-rated, opposed-blade design; minimum of 0.1084-inch thick, galvanized-steel frames with holes for duct mounting; minimum of 0.0635-inch thick, galvanized-steel damper blades with maximum blade width of 8 inches.
1. Secure blades to ½-inch diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.

2. Operating Temperature Range: From minus 40 to plus 200 deg F.

3. Provide parallel- or opposed-blade design with inflatable seal blade edging, or replaceable rubber seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is being held by torque of 50 in.xlbf (5.6 N×m); when tested according to AMCA 500D.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and NAIMA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.

B. When installing volume dampers in lined duct, avoid damage to and erosion of duct liner.

C. Install manual volume dampers at all main branch lines for ease of balancing.

D. Provide test holes at fan inlet and outlet and elsewhere as indicated.

E. Install fire and smoke dampers according to manufacturer's UL-approved written instructions.
   1. Install fusible links in fire dampers.

F. Install mounting angles, minimum of 1 ½ "x 1 ½ "x 20 gauge steel on both sides of SFD or FD.

G. Install duct access panels for access to both sides of duct coils. Install duct access panels downstream from volume dampers, fire dampers, smoke-fire dampers, turning vanes, and equipment.

H. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting and maintaining accessories and terminal units.
   1. Install access panels on side of duct where adequate clearance is available.
   2. Label access doors according to Specification Section “Mechanical Identification.”

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.
C. Final positioning of manual-volume dampers is specified in Specification Section "Testing, Adjusting, and Balancing."

END OF SECTION
SECTION 23 36 01
DUAL DUCT AIR TERMINAL UNITS

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. Dual-duct air terminal units.

1.3 SUBMITTALS
A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories.

B. Specification Compliance Review:
   1. Manufacturers and bidders must provide the consulting engineer with a Compliance Review of the Specifications and Addenda’s. The Compliance Review shall be a paragraph-by-paragraph review of the Specifications and schedule with the following information; “C”, “D”, or “E” marked in the margin of the original Specifications and any subsequent Addenda’s. If the manufacturer or bidder does not provide the Compliance Review to the engineer for review, with the submittal, the submittal will be subject to rejection as non-compliant.
      a. “C” Comply with no exceptions.
      b. “D” Comply with deviations. For each and every deviation, provide a numbered footnote with reasons for the proposed deviation and how the intent of the Specification can be satisfied.
      c. “E” Exception, do not comply. For each and every exception, provide a numbered footnote with reasons and possible alternatives. Non-compliance with the specifications is grounds for rejection as unacceptable. A bid from any alternative or listed equipment manufacturer with any number of exceptions will be reason for rejection for non-compliance without further review.
      d. Unless a deviation or exception is specifically noted in the Compliance Review, the manufacturer shall provide full compliance with entire specification. Deviations or exceptions taken in letters or cover letters in a bid document, subsidiary documents, by omission or by contradiction do not release the manufacturer or bidder from being in complete compliance,
unless the exception or deviation has been specifically noted in the Compliance Review and approved by the consulting engineer.

e. Equipment manufacturers or bidders that do not meet the specifications thru the above process will be subject to rejection without further review.

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.

   1. Include a schedule showing unique model designation, room location, model number, size, and accessories furnished.
   2. Wiring Diagrams: Power, signal, and control wiring.

D. Coordination Drawings: Reflected ceiling 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. Ceiling suspension assembly members.
   2. Method of attaching hangers to building structure.
   3. Size and location of initial access modules for acoustical tile.
   4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

E. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Section "Operation and Maintenance Data" include the following:

   1. Instructions for resetting minimum and maximum air volumes.
   2. Instructions for adjusting software set points.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air terminal units and are based on the specific system indicated. Refer to Section "Product Requirements."

B. 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.

C. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

D. ARI Certified: Terminal units shall be certified and labeled in accordance with the ARI Standard 880 Certification Program.

1.5 COORDINATION

A. Coordinate layout and installation of air terminal units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 DUAL-DUCT AIR TERMINAL UNITS

A. Manufacturers:
   1. Krueger.
   2. METALAIRE, Inc.; Metal Industries Inc.
   3. Nailor Industries of Texas Inc.
   5. Titus.

B. Configuration: Two volume dampers inside unit casing with mixing attenuator section and control components located inside a protective metal shroud.

C. Casing: 0.034-inch steel.
   1. Casing Lining:
      a. Foil-faced insulation: 1-inch thick, coated, 4-lb density, fibrous-glass duct liner complying with ASTM C 1071, UL 181 and NFPA 90A; secured with adhesive. Cover liner with nonporous foil.
   2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
   3. Air Outlet: S-slip and drive connections.
   4. Access: Removable panels for access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket.
   5. Dimensions and other requirements: Provide equivalency to model/manufacturer specified on drawing schedule.

D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
   1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.

E. Control Transformer: Class II, 24-volt; refer to drawing schedules for line voltage.

F. DDC Controls: Single-package unitary controller and actuator specified in Specification Section "Instrumentation and Control for HVAC." Controller and actuator shall be shipped from DDC control provider to terminal unit manufacturer for factory installation.
2.3 SOURCE QUALITY CONTROL

A. Identification: Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

B. Verification of Performance: Rate air terminal units according to ARI 880.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units level and plumb. Maintain sufficient clearance for code compliance, and normal service and maintenance.

B. Provide a minimum three (3) inlet-duct diameters of straight duct upstream of inlet.

C. Install air terminal units at a maximum elevation of 12-inches above the ceiling.

3.2 CONNECTIONS

A. Connect ducts to air terminal units with flexible canvas connections; refer to Specification Section "Metal Ducts" for additional requirements.

B. Connect wiring according to Specification Section "Low-Voltage Electrical Power Conductors and Cables."

C. 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 and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
   1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.
3.4 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 and do the following:
   a. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
   b. Verify that controls and control enclosure are accessible.
   c. Verify that control connections are complete.
   d. Verify that nameplate and identification tag are visible.
   e. Verify that controls respond to inputs as specified.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units. Refer to Section "Demonstration and Training."

END OF SECTION
SECTION 23 37 13
DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

B. Related Sections include the following:
   1. Specification Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.
   2. Specification Section "Testing, Adjusting, and Balancing" for balancing diffusers, registers and grilles.

1.3 DEFINITIONS

A. Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.

B. Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.

C. Register: A combination grille and damper assembly over an air opening.

1.4 SUBMITTALS

A. Product Data: For each model indicated, include the following:
   1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
   2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
   3. Schedule of diffusers, registers, and grilles indicating drawing designation, model number, size, and accessories furnished.
   4. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.
1.5 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS
   A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1. Krueger
      2. Metalaire
      3. Price
      4. Titus
   B. Performance characteristics, specific models, material, features, dimensions and finishes of diffusers, registers, and grilles are scheduled on Drawings.

2.2 SOURCE QUALITY CONTROL
   A. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION
   A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.
   B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Coordinate with architectural Reflected Ceiling Plans. Locate devices where indicated, as much as practical. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
C. Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 CLEANING

A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Demolition and removal of selected portions of building or structure.
   2. Salvage of existing items to be reused or recycled.

B. Related Sections include the following:
   1. Division 1 Section “Summary” for use of premises, phasing, and Owner-occupancy requirements.
   2. Division 1 Section “Photographic Documentation” for preconstruction photographs taken before selective demolition operations.
   3. Division 1 Section “Temporary Facilities and Controls” for temporary construction and environmental-protection measures for selective demolition operations.
   4. Division 1 Section “Construction Waste Management” for disposal of demolished materials.
   5. Division 1 Section “Cutting and Patching” for cutting and patching procedures.
   6. Division 2 Section “Building Demolition” for demolition of entire buildings, structures, and site improvements.

1.3 DEFINITIONS

A. Remove or Demolish: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner cleaned, packaged, and ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 SUBMITTALS

A. Schedule of Selective Demolition Activities: Indicate the following:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
   2. Coordination of Owner’s continuing occupancy of portions of existing building and of Owner’s partial occupancy of completed Work.
   3. Means of protection for items to remain and items in path of waste removal from building.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI A10.6 and NFPA 241.

1.6 PROJECT CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is unknown whether hazardous materials will be encountered in the Work.
   1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.
1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Trace circuits feeding existing to-remain portions of the building. Do not demolish circuits in these areas. If circuits are in both “to remain” and “to be removed” areas, demolish back to nearest to-remain J-Box.

F. Provide to the Engineer a diagram and index of circuits traced in the “to remain” areas.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
   1. Comply with requirements for existing services/systems interruptions specified in Division 1 Section “Summary.”

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with adjacent occupied and used facilities.
   1. Comply with requirements for access and protection specified in Division 1 Section “Temporary Facilities and Controls.”
3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
   3. Maintain adequate ventilation when using cutting torches.
   4. Dispose of demolished items and materials promptly.

B. Removed and Salvaged items:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner’s storage area designated by Owner.
   5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:
   1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
   2. Pack or crate items after cleaning and repairing. Identify contents of containers.
   3. Protect items from damage during transport and storage.
   4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition [and cleaned] and reinstalled in their original locations after selective demolition operations are complete.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner’s property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.
C. Disposal: Transport demolished materials off Owner’s property and legally dispose of them.

END OF SECTION
SECTION 26 00 15

GENERAL CONDITIONS FOR ALL ELECTRICAL WORK

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including Conditions of the Contract (General and Supplementary Conditions) and Division 1 specification sections, apply to work of this section.

B. The requirements of this section apply to all sections of electrical, signal, and life safety, and all sections that are installed by the electrical contractor to include electrical work done under the mechanical contractor.

1.2 DESCRIPTION OF WORK

A. This section covers the general provisions of the electrical specifications applicable to the following systems:
   1. Electrical power and lighting.
   2. All Special Systems (fire alarm, A/V, telephone, data, television, and annunciators associated with power).
   3. Control wiring associated with electrical or mechanical equipment.

B. The use of the word “electrical” in any specification contained within the electrical, signal, or life safety division sections shall include all aspects of each system complete install. This shall be extended to mechanical or plumbing signal systems.

C. The use of the work “life safety” shall refer to all fire alarm, fire protection, and mass notification systems installed by the electrical contractor.

D. The use of the word “mechanical” shall refer to both mechanical and plumbing.

E. The use of the word “pipe” shall refer to all electrical raceway.

1.3 DRAWINGS

A. These specifications are accompanied by drawings of the building and details of the installations showing the locations of equipment, lighting, panels, etc. The drawings and these specifications are complementary to each other, and what is called for by one shall be as binding as if called for by both.

B. Drawings and specification conflicts shall be identified as early as possible to ensure conflict resolution prior to installation. The contractor shall not install any equipment...
with known conflicts or pending information requests. The contractor shall contact the Engineer of Record or their representative for information clarification prior to installing any item that is in question. The contractor shall not install any equipment that is not consistent with the manufacturers approved installation instructions unless directed by the engineer.

C. In all cases all installations shall be at least in accordance with all the approved codes and their local amendments. The drawings and specifications may exceed local code allowances and the most stringent applies. The existence or allowance of a practice or product by code does not supersede requirements of the drawings and specifications. In other words, just because it is allowed by code does not mean that it is allowed on this project.

D. If any departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Owner’s Representative for approval. No departures shall be made without prior written approval by the Owner’s Representative.

E. There are intricacies of construction which are impractical to specify or indicate in detail; however, in such cases, the current rules of good practice and applicable specifications shall govern. In all cases the requirements specified in the NEC and local jurisdiction shall be followed.

F. It is the Contractor’s responsibility to properly use all information found on the Architectural, Structural, Mechanical, and Electrical drawings and applicable shop drawings where such information affects his work. The contractor shall review the entire construction document set both prior to bid and construction.

G. All dimensional information related to new structures shall be taken from the appropriate drawings. All dimensional information relative to existing facilities shall be taken from actual measurements made by the Contractor on the site.

H. Any duplicate circuiting listed on the drawings shall be bid as multiple circuits with the intention of the next available circuit and breaker to be used. The contractor shall bring this to the attention of the engineer for clarification and updating the drawings. The new circuit numbers shall be annotated on both the panel schedules and the record drawings. The contractor is not required to follow the exact circuit numbers on the panel schedules (balancing phases, wiring convenience, or conduit routing installation), however, the contractor is responsible for keeping the panel schedules accurate and up to date in addition to ensuring the circuit numbers are identified correctly.

I. Any installation that is not in compliance with these requirements shall be corrected at the contractors cost and responsibility.

1.4 BIDDING
A. The contractor is responsible for bidding complete and working systems. In the event that some part of the system is not included in the construction document or the specifications and it is a necessary part of the system to work properly, the contractor shall include that work as part of the bid amount. This includes, but not limited to:

1. Power for equipment shown on the drawings. Examples include, but are not limited to:
   a. Equipment Panels
   b. Controllers
   c. Electronic Devices
   d. Mechanical Equipment
   e. Plumbing Equipment

2. Cabling to communicate with the head end equipment. Examples include, but are not limited to:
   a. Fire Alarm
   b. Switching
   c. Equipment starters and the switching locations

B. The contractor is not responsible for interpreting additional accessory options that are not included in the drawings or specifications or equipment that is not shown or indicated as part of the entire contract documents or specifications.

C. The contractor shall review the entire set of specifications and contract documents for all equipment and connections requiring electrical work.

1.5 CONSTRUCTION REQUIREMENTS

A. The architectural, structural, mechanical, plumbing and electrical plans and specifications and other pertinent documents issued by the Architect are a part of these specifications and the accompanying electrical drawings, and shall be complied with in every respect. All the above is included in the Contract Documents, and shall be examined by all bidders. Failure to comply shall not relieve the Contractor of responsibility or be used as a basis for additional compensation because architectural, structural, or mechanical details were not included in the electrical drawings.

B. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction may be required for work indicated or specified in this section or work specified in other sections, it shall be the responsibility of the Contractor to provide same as well as to provide material and equipment usually furnished with such systems or required to complete the installation, whether mentioned or not.

C. The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to avoid all obstructions, to comply with Codes, to facilitate the work of
other trades, to conform to the details of the installation supplied by the manufacturer of the equipment to be installed, and thereby to provide an integrated satisfactory operating installation.

D. The mechanical, electrical, and associated drawings are necessarily diagrammatic in character and do not show every connection in detail or every pipe or conduit in its exact location. These details are subject to the requirements of ordinances and also structural and architectural conditions. It shall be the contractor's responsibility to coordinate with other disciplines to facilitate their equipment installation.

E. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases and above suspended ceilings, etc. in finished portions of the building, unless specifically noted to be exposed. Work shall be installed to avoid crippling of structural members; therefore, inserts to accommodate hangers shall be set before concrete is poured, and proper openings through floor, walls, beams, etc. shall be provided as hereinafter specified or as otherwise indicated or required. All work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

F. Conduit and equipment are generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner. The plans do not show all required offsets, elbows, and other location details. Work shall be concealed in all finished areas. Conduit is intended to be installed with factory fittings or bent in a professional, workmanlike manner.

G. All parts of equipment requiring adjustment shall be easily accessible. Equipment shall be so located and installed as to permit convenient and safe maintenance and future replacement. The trade furnishing the equipment shall be responsible for notifying the Contractor, who shall notify the Owner's Representative prior to ordering same in the event that equipment specified and/or proposed is incompatible with this requirement.

H. Location of Lighting and Outlets in Rooms:
1. All lighting, plumbing, acoustical tile, modular lighting outlets, diffusers, sprinkler heads, grilles, registers, and other devices shall be referenced to coordinated, established data points and shall be located to present symmetrical arrangements with these points and to facilitate the proper arrangements of acoustical tile panels and other similar panels with respect to the mechanical outlets and electrical lighting and devices. Those mechanical and electrical outlets shall be referenced to such features as wall and ceiling furring’s, balanced border widths, masonry joints, etc. Outlets in acoustical tile shall occur symmetrically in tile joints or in the centers of whole tiles. The final
determination of the exact location of each outlet and the arrangements to be followed shall be acceptable to the Owner’s Representative.

2. The drawings show diagrammatically the locations of the various outlets and apparatus. Exact locations of these outlets and apparatus shall be determined by reference to the general plans and to all detail drawings, equipment drawings, roughing-in drawings, etc. by measurements at the building, and in cooperation with the other trades. The Owner reserves the right to make any reasonable change in location of any outlet or apparatus before installation, without additional cost to the Owner or the Architect. Contractor shall coordinate work with architectural reflective ceiling plan.

I. The Contractor, by submitting a bid on this work, sets forth that he has the necessary technical training and ability, and that he will install his work in a satisfactory and workmanlike manner which is up to the best standards of the trade, complete and in good working order. If any of the requirements of the plans and specifications are impossible of performance, or if the installation when made in accordance with such requirements will not perform satisfactorily, he shall report same to the Owner's Representative for correction promptly after discovery of the discrepancy.

J. No extra compensation will be allowed for extra work or change caused by failure to comply with the above requirements.

1.6 JOB CONDITIONS

A. Submittal of bid implies bidder has read paragraphs of the specifications and will be bound by their conditions.

B. Contractor Qualifications: A minimum of five years’ experience installing commercial electrical power lighting and special systems, similar to those described in these specifications, and make available at the owner or engineer’s request a list of five previous projects including name of project and contact person names and phone numbers as a separate document in addition to the bid or proposal submitted.

C. Contractor must be licensed and hold a current contracting license that has been valid for a minimum of five years in the local State.

D. Contractor must be able to bond work for performance of work being bid and provide a written statement from the bonding agency proposed to be used for this project as a separate document in addition to the bid or proposal submitted. The bonding agency proposed to be used shall have a Bests insurance rating of A or A+.

1.7 INSPECTION OF THE SITE

A. The Contractor shall visit the site, verifying all existing items indicated on drawings and/or specified, and familiarize himself with the existing work conditions, hazards, grades, actual formations, soil conditions, structures, utilities, equipment, systems,
facilities, and local requirements. The submission of bids shall be deemed evidence of such visits. All proposals shall take these existing conditions into consideration, and the lack of specific information shall not relieve the Contractor of any responsibility.

1.8 PERMITS, UTILITY CONNECTIONS, AND INSPECTIONS

A. Fees and Costs: The contractor shall obtain and pay for all permits and inspection fees, for all work included therein.

B. Compliance: The Contractor shall comply in every respect with all requirements of local inspection departments, Board of Fire Underwriters, local ordinances and codes, and utility company requirements. In no case does this relieve the Contractor of the responsibility of complying with these specifications and drawings where specified conditions are of a higher quality than the requirements of the above-specified offices. Where requirements of the specifications and drawings are below the requirements of the above offices having jurisdiction, the Contractor shall make installations in compliance with the requirements of the above offices.

C. Certification: Prior to final acceptance, the Contractor shall furnish a certificate of acceptance from the inspection departments having jurisdiction over the work for any and all work installed under this Contract. Any additional labor costs incurred as a result of a substitution shall be the Contractor’s responsibility.

1.9 EXISTING FACILITIES

A. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection, and in-service maintenance of all electrical and special systems for the new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work. Barricades shall clearly indicate with signage that which they are protecting. Contractor shall observe all OSHA rules.

B. The Contractor shall provide temporary or new services to all existing facilities as required to maintain their proper operation when normal services are disrupted as a result of the work being accomplished under this project.

C. Where existing construction is removed to provide working and extension access to existing utilities, Contractor shall remove doors, piping, conduit, outlet boxes, wiring, light fixtures, and equipment, etc. to provide this access and shall reinstall same upon completion of work in the areas affected.
D. Where partitions, walls, or ceilings of existing construction are indicated to be removed, all Contractors shall remove and reinstall in locations approved by the Architect/Engineer all devices required for the operation of the various systems installed in the existing construction. This is to include but is not limited to temperature controls system devices, electrical switches, relays, fixtures, piping, conduit, etc.

E. Outages of services as required by the new installation will be permitted but only at a time approved by the Owner. The Contractor shall allow the Owner two weeks in order to schedule required outages. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including overtime charges, shall be included in the contract amount. Unless otherwise scheduled by the Owner, planned shutdowns of the existing facilities shall occur between 6 p.m. Friday through 5 am Monday. The existing building shall be ready for morning start-up by 5 am Monday.

1.10 DEMOLITION AND RELOCATION

A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination or otherwise disposed of as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

B. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the Contractor's responsibility and shall be repaired or replaced by the Contractor as approved by the Owner, at no additional cost to the Owner.

D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at
which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as hereinbefore specified.

1.11 SUBMITTAL DATA

A. General: As soon as practical and within 30 days after the date of award of contract and before purchasing or starting installation of any materials or equipment, the Contractor shall prepare or cause to be prepared shop drawings, product data, materials and equipment lists, diagrams, data, samples, and other submittals as required by the contract documents, hereinafter referred to as “Submittal Data.” The Contractor shall review and approve all submittal data for compliance with the contract documents, manufacturer’s recommendations, adequacy, clearances, code compliance, safety, and coordination with associated work.

B. The Contractor shall submit approved submittal data to the Owner’s Representative for review and comment as to general conformance with the design concept and general compliance with information given in the contract documents. Owner’s Representative’s review shall not include review of quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with other trades or work, or construction safety and precautions, all of which are the sole responsibility of the Contractor. The reviewers shall make every effort to “catch” discrepancies and identify these to the contractor prior to ordering equipment. However, it shall remain the contractor’s responsibility to order and install the equipment as listed in the drawings and specifications. At the owner’s representative’s discretion, a detailed submittal may be required.

C. Substitutions shall be clearly identified as such in the submittal by a cover sheet indicating that items are different from what is specified or scheduled. It shall be the contractor responsibility to provide complete substitution information so an accurate comparison can be made.

D. Detail Submittals: Materials and equipment requiring detailed submittal data shall be submitted with sufficient data to indicate that all requirements of the specifications have been met and samples shall be furnished when requested. All manufacturer’s data used as part of the submittal shall have all non-applicable features crossed out or deleted in a manner that will clearly indicate exactly what is to be furnished. The detailed submittals shall be accompanied by the same number of sets of pictorial and descriptive data derived from the manufacturer’s catalogs and sales literature, or incorporated in the shop drawings. The Contractor may provide a detailed submittal on any item even though not required by the Owner’s Representative.
E. The Engineer’s review of Shop Drawings and Brochures shall not relieve the Contractor of the responsibility for dimensions, errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the Engineer’s noting some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the submittal data review.

F. The Contractor shall clearly and specifically identify and call to the attention of the Owner’s Representative any deviation from the contract documents for which Owner acceptance is desired. The responsibility for such a deviation accepted by the Owner shall remain with the Contractor.

G. Timeliness: The burden of timeliness in the complete cycle of submittal data is on the Contractor. The Contractor shall allow a minimum of three (3) weeks’ time frame for the submittal cycle of each submission by the Owner’s Representative. The Contractor is responsible for allowing sufficient time in the construction schedule to cover the aforementioned cycles of data processing, including time for all re-submission cycles on non-conforming materials, equipment, etc. covered by the data submitted. Construction delays and/or lack of timeliness in the above regard are the responsibility of the Contractor and will not justify any request for scheduled construction time extensions or extra compensation.

H. Work performed in accordance with approved submittal data that is not in accordance with the Contract Documents and did not have the specific acceptance of the Owner’s Representative shall be replaced at Contractor’s cost.

I. Submittals shall be provided in the following format:
   1. The submittal brochures shall be in pdf format. The first page shall be titled “ELECTRICAL SUBMITTAL INFORMATION” and shall list the name and location of project, the Owner, the Engineer(s), the General Contractor, and the Subcontractors installing equipment represented in the brochure.
   2. A table of contents will follow the first page and shall list all of the sections contained in the specifications manual. Each section will be tabbed and will include its respective brochures. All brochures will be three-hole punched and folded (if required). Each submittal section will correspond to the appropriate specification section number.
   3. Provide submittal data for all materials to be used on this project as indicated in each specifications manual section.
   4. Brochures submitted shall contain only information which is relevant to the particular equipment or materials to be furnished. Do not submit catalogs that describe several different items other than those items to be used unless all irrelevant information is marked out or relevant information is clearly marked.
   5. Brochures: Brochures submitted to the Engineer shall be published by the Manufacturers and shall contain complete and detailed engineering and
6. Any submittal that is disapproved must be resubmitted within two (2) weeks following notification of such disapproval. If no satisfactory material is submitted within the two-week period, the Engineer reserves the right to require the Contractor to furnish items exactly as described in the Contract Documents.

7. Unless a greater number is indicated within Division 1 of these specifications, submit six (6) copies of all submittal materials for review, or electronic copy as approved by the architect.

8. No allowances will be made for submittals which are not made in a timely fashion or which are turned down because they do not meet the specifications. Should delivery problems arise due to the above, affecting the completion time of the project, the Contractor will furnish and install acceptable alternates until the proper materials arrive and then replace the alternate materials with the approved materials, all at no cost to the Owner, Architect, or Engineer. If the Contractor is not able to furnish an acceptable alternate until the proper materials arrive, he will assume all costs for furnishing and installing all alternates as directed by the Engineer.

9. Submittal shall have the certification information as listed hereafter.

10. Shop Drawings:
   a. All shop drawings shall have the certification as listed hereafter.
   b. Each Shop Drawing shall indicate in the lower right hand corner and each Brochure shall indicate on the front cover the following: Title of the Sheet or Brochure; name and location of the building; names of the Engineer, Contractor, Manufacturer, Supplier, Vendor, etc., the date of submittal; and the date of each correction and revision. So far as is practical, each Shop Drawing and/or Brochure shall bear a cross-reference note to the sheet number or numbers of the Contract Drawings and Specifications showing the same work. Shop Drawings shall be prepared as follows:
      1) Shop Drawings: Drawings shall be newly prepared and not reproduced from the Contract Documents, drawn to a scale that can be easily read and shall contain sufficient plans, elevations, sections, and isometrics to describe clearly the items in question. Drawings shall be prepared by a draftsman skilled in this type of work. All equipment layouts and similar Shop Drawings shall be drawn to at least 1/4-inch = 1'-0" scale.
      2) All Shop Drawings shall indicate the equipment actually purchased. The elevation, location, support points, load imposed on the structure at support and anchor points, shall be indicated. All beam penetrations and slab penetrations shall be indicated and sized and shall be coordinated. All Design Drawing space allocations shall be maintained, such as ceiling height, chase walls, equipment room size, etc., unless proper written authorization is required from the Engineer to change them. All associated equipment shall be coordinated and clearly shown on the Shop Drawings.
11. Submittal data for each section must be complete. Partial submittals, or
submittals not in the specified format, will be rejected and returned to the
Contractor without further review.

J. All equipment installed on this project shall have local (within 125 miles)
representation, local factory-authorized service, and a local stock of repair parts. This
requirement is essential and will be strictly reviewed by the Owner’s Representative
prior to concurrence with the Contractor's approval for all submittals covered by
electrical division sections.

K. Physical Size of Equipment: Space is critical; therefore, equipment of larger sizes
than shown, even though of approved manufacturer, will not be acceptable unless it
can be demonstrated that ample space exists for proper installation, operation, and
maintenance.

L. These paragraphs related to electrical divisions submittal data rescind, amend, and
supersede any provisions to the contrary contained in the Project Manual.

1.12 CERTIFICATION OF SUBMITTAL DATA

A. The Contractor shall provide the following notarized certificate with all submittal
data furnished to the Owner’s Representative for review and comment.

   Project Title:

   Description of Submittal Data:

   This is to certify that the above-described submittal data has been
reviewed and is approved for compliance with the Contract Documents,
manufacturer’s recommendation, adequacy, clearances, code compliance,
safety, and coordination with other trades and/or work except as follows:
(list “none” or itemize and explain). In addition, the Contractor shall
submit to the Owner’s Representative a signed statement from each
representative certifying as follows:

   EXCEPTIONS:

   “I certify that the materials and/or equipment listed below have been
personally inspected by the undersigned authorized manufacturer’s representative
and is properly installed and operating in accordance with the manufacturer's
recommendations and are asbestos free.”
1.13 ACCEPTANCE OF MATERIALS AND EQUIPMENT

A. Owner’s Manual: After the submittals have been accepted the Contractor is requested to include a minimum of three (3) additional copies for insertion in the project Owner’s Manuals at the completion of the project.

B. NOTICE: The Contractor is responsible for providing materials and equipment that conform to the requirements of the project manual in every respect unless a deviation has been “accepted” in writing. Removal of any nonconforming materials and equipment and the replacement with conforming materials and equipment shall be at the Contractor’s sole expense, regardless of when nonconformance was discovered. If the owner or owner’s representative elects to keep the equipment it shall be contractor’s responsibility to provide any additional connections or services required to make the equipment function as specified or required by the manufacturer. The contractor shall coordinate with other subs for any different material requirements (wire size, breakers, cooling, mounting requirements, etc.).

C. Approval of materials and equipment shall be based on manufacturer’s published data and shall be tentatively subject to the submission of complete shop drawings which comply with the contract documents. Approval is also dependent upon the existence of adequate and acceptable clearances for entry, servicing, and maintenance.

D. Approval of materials and equipment under this provision shall not be construed as authorizing any deviations from the specifications, unless the attention of the Owner’s Representative has been directed in writing to the specific deviations. Data submitted shall not contain unrelated information unless all pertinent information is properly identified.

1.14 SHOP DRAWINGS

A. As soon as practicable after the award of contract and approval of materials and equipment, but prior to installation, complete and detailed shop drawings of the following shall be submitted for review and comment:
   1. Equipment arrangements.
   2. Fire alarm system.
   3. Data drops.
   5. Anchors.
   6. Control.
   7. Interlock.
   8. Other details as directed by the Owner’s Representative. Composite drawings of areas requiring coordination between trades shall be provided and expedited to eliminate conflicts and to ensure maximum cooperation and work progress.
B. Work performed without benefit of reviewed and approved shop drawings will not be recommended for payment by the Engineer until such time as the shop drawings are submitted, reviewed, and approved. Any work performed without the benefit of reviewed and approved shop drawings may require removal, relocation, and/or replacement at the Contractor’s sole expense in order to resolve conflicts between the various systems and provide the performance specified.

C. All installation of equipment, fixtures, terminal devices, etc. shall be made in accordance with approved composite shop drawings. The Contractor shall modify installation and relocate installed work to provide code clearances, service access, and eliminate conflict with other systems.

D. Submit one copy of shop drawings with each submittal. The shop drawing shall be marked with the A/E comments and returned to the Contractor for printing and distribution. Distribution shall include the return of three (3) prints of the approved shop drawings, with the A/E’s comments included, to the A/E for the A/E’s and Owner’s use. Electronic copies may be acceptable at the discretion of the architect/owner.

1.15 SITE OBSERVATION

A. Site observation by the Architect, Engineer, and/or Owner’s Representative is for the express purpose of verifying compliance by the Contractor with the contract documents, and shall not be construed as construction supervision nor indication of approval of the manner or location in which the work is being performed as being a safe practice or place.

1.16 SUPERVISION

A. In addition to the Superintendent required under the conditions of the contract, each subcontractor shall keep a competent superintendent or foreman on the job at all times.

B. It shall be the responsibility of each superintendent to study all plans and familiarize himself with the work to be done by other trades. He shall coordinate his work with other trades and, before material is fabricated or installed, make sure that his work will not cause an interference with another trade. Where interferences are encountered, they shall be resolved at the jobsite by the superintendents involved. Where interferences cannot be resolved without major changes to the plans, the matter shall be referred to the Owner’s Representative for comments.

1.17 OPERATION PRIOR TO COMPLETION

A. When any piece of electrical equipment is operable and it is to the advantage of the Contractor to operate the equipment, he may do so, providing that he properly
supervises the operation and has the written permission of the Owner’s Representative to do so. The contractor shall energize the power distribution in a timely manner to facilitate completion of other trades work. Electrical lighting shall be energized after ceiling has been completed. New permanent fixtures shall not be used as temporary under any circumstances. The warranty period shall not commence, however, until such time as the equipment is operated for the beneficial use of the Owner or date of substantial completion, whichever occurs first.

B. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, properly adjust, and complete all deficiency list items before final acceptance by the Owner. The date of acceptance and the start of the warranty may not be the same date.

1.18 MANUFACTURER’S RECOMMENDATIONS

A. The manufacturer’s published directions shall be followed in the delivery, storage, protection, installation, piping, and wiring of all equipment and material. The Contractor shall promptly notify the Owner’s Representative, in writing, of any conflict between the requirements of the contract documents and the manufacturer’s directions, and shall obtain the Owner’s Representative’s comments before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer’s directions or applicable comments from the Owner’s Representative, he shall bear all costs arising in connection with the correction of such deficiencies.

1.19 CHECKING AND TESTING MATERIALS AND/OR EQUIPMENT

A. Before final acceptance of the work, an authorized representative of the manufacturer of the installed materials and/or equipment shall personally inspect the installation and operation of his materials and/or equipment to determine that it is properly installed and in proper operating order. Testing and checking shall be accomplished during the course of the work where required by work being concealed, and at the completion of the work otherwise. In addition, the Contractor shall submit to the Owner's Representative a signed statement from each representative certifying as follows:

“I certify that the materials and/or equipment listed below have been personally inspected by the undersigned authorized manufacturer’s representative and is properly installed and operating in accordance with the manufacturer’s recommendations and are asbestos free.”

1.20 OPERATING AND MAINTENANCE INSTRUCTION

A. The Contractor shall prepare for the owner’s manual hereinafter specified complete sets of operating and maintenance instruction’s, control and interlock diagrams,
B. In addition, the Contractor shall provide the service of a competent engineer or a technician acceptable to the Owner’s Representative to instruct a representative of the Owner in the complete and detailed operation of all equipment and systems. These instructions shall be provided for a period of sufficient duration to fully accomplish the desired results. Upon completion of these instructions, a letter of release will be required, acknowledged by the Owner, stating the dates of instruction and personnel to whom instructions were given.

C. Additional diagrams, operating instructions, etc. shall be provided as specified hereinafter in the other sections of these specifications.

1.21 MATERIAL AND EQUIPMENT SCHEDULES

A. Contractor shall refer to both drawings and specification for schedules. Where reference is made to items “scheduled on drawings” or “scheduled in specifications,” same shall include schedules contained in both the drawings and the specifications. The Contractor’s attention is directed to the various specification sections and drawings for schedules.

1.22 APPLICABLE CODES AND STANDARDS

A. The installation shall meet the minimum standards prescribed in the latest editions of the following listed codes and standards, which are made a part of these specifications, except as may be hereinafter specifically modified in these specifications and associated drawings.

1. National Fire Protection Association Standards (NFPA):
   a. NFPA No. 10, Portable Fire Extinguishers
   b. NFPA No. 54, National Fuel and Gas Code
   c. NFPA No. 70, National Electrical Code
   e. NFPA No. 255, Method of Test of Surface Burning Characteristics of Building Materials

   b. A117.1, Handicapped Code

3. American Society of Mechanical Engineers (ASME): Section IV, V, CSD-1


5. National Electrical Manufacturers Association (NEMA): All applicable manuals and standards.


7. Occupational Safety and Health ACT (OSHA): National Sanitation Foundation, Standard No. 2
8. Americans with Disabilities Act, 1990
9. American Gas Association (AGA)
10. Underwriters Laboratories, Inc. (UL)
11. Applicable State Building Codes (Uniform Building Codes, as amended):
12. All County codes related to mechanical, electrical, plumbing, and system equipment; piping; conduit; wiring; etc. furnished and installed under these specifications.
13. All City ordinances related to mechanical, electrical, plumbing, and systems and equipment; piping; conduit; wiring; etc. furnished and installed under these specifications.
14. Refer to specification sections heretofore bound for additional codes and standards.

B. All materials and workmanship shall comply with all applicable city, state, and national codes, specifications, and industry standards. All materials shall be listed by the Underwriters Laboratories, Inc. as conforming to its standards and so labeled in every case where such a standard has been established for the particular type of material in question.

C. The contract documents are intended to comply with the aforementioned rules and regulations; however, some discrepancies may occur. Where such discrepancies occur, the Contractor shall immediately notify the Owner’s Representative in writing of said discrepancies and apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with said regulations shall be paid for as covered by Division 1 of these contract documents, providing no work or fabrication of materials has been accomplished in a manner of noncompliance. Should the Contractor fabricate and/or install materials and/or workmanship in such a manner that does not comply with the applicable codes, rules, and regulations, the Contractor who performed such work shall bear all costs arising in correcting these deficiencies to comply with said rules and regulations.

1.23 DEFINITIONS

A. Refer to the condition of the contract for Division 1 for additional requirements regarding definitions.

B. Where “as required” is used in these specifications or on the drawings, it shall mean “that situations exist that are not necessarily described in detail or indicated that may cause the Contractor certain complications in performing the work described or indicated. These complications entail the normal coordination activities expected of the Contractor where multiple trades are involved and new or existing construction causes deviations to otherwise simplistic approaches to the work to be performed. The term shall not be interpreted to permit an option on the part of the Contractor to achieve the end result.”

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C. Where “and/or” is used in these specifications or on the drawings, it shall mean that situations exist where either one or both conditions occur or are required and shall not be interpreted to permit an option on the part of the Contractor.

D. Unless specifically indicated otherwise elsewhere in these specifications or on the drawings the word “furnish” or any of its derivatives shall be understood to indicate the purchase, delivery, storage and protection of an item at the job site in a location and manner suitable for use by the recipient who will be responsible for installation of this item. The word “install” or any of its derivatives shall be understood to indicate taking receipt of an item, properly mounting it, and providing the related utilities (electrical, communication, etc.) for proper and complete operation of the item. Installation shall also include calibration, programming and operational testing of said item. The word “provide” or any of its derivatives shall be understood to indicate both furnishing and installing an item.

1.24 SUBSTANTIAL COMPLETION

A. Refer to Division 1 for additional requirements for substantial completion.

B. Substantial completion shall be defined as the level of project completion where the owner is ready to occupy the building. The contractor shall have ensured that all mechanical, electrical, plumbing, and building systems (elevators, automatic doors, hardware, security, etc.) are complete and in fully functional working order. This level of completion does not absolve the contractor from the requirements of final inspection or final acceptance. The contractor shall ensure there are no life safety issues unresolved with the project at the time of substantial completion.

C. All “punch” list items shall have been resolved or shall be identified as pending resolution. Items listed as unresolved shall be either pending information or direction from the owner or owner’s representative or shall be awaiting parts or supplies that are “on order”. The contractor at the owners discretion shall produce documentation of the part or supply on order status.

1.25 FINAL INSPECTION

A. Refer to Division 1 for additional requirements for final inspection.

B. It shall be the responsibility of the Contractor to personally conduct a careful inspection, assuring himself that the work on the project is ready for final acceptance and developing his own “punchlists,” before calling upon the Owner’s Representative to make a final inspection. Failure of the Contractor to conduct such inspections and provide the Owner’s Representative with a copy of his “punchlists” prior to the final inspection shall be adequate cause for the Owner’s Representative to cancel any Contractor-requested final inspection.
C. In order not to delay final acceptance of the work, the Contractor shall conduct his own “final inspections” prior to requesting the Owner’s Representative to “final” the project; will have all necessary bonds, guarantees, receipts, affidavits, etc. called for in the various articles of this specification prepared and signed in advance; and together with a letter of transmittal listing each paper included, shall deliver the same to the Owner’s Representative at or before the time of said final inspection. The Contractor is cautioned to check over each bond, receipt, etc. before preparing same for submission to see that the terms check with the requirements of the specifications.

D. The final inspection will be made jointly by the Owner’s Representative and the Owner.

1.26 REQUIREMENTS FOR FINAL ACCEPTANCE

A. Requirements for final acceptance shall include but not be limited to the Contractor accomplishing the following:
   1. Construction: Complete all construction.
   2. Deficiency Lists: Correct all deficiencies listed at time of Substantial Completion.
   3. Owner’s Manual: Submit at least 30 days prior to final acceptance one (1) copy of the owner’s manual for the Owner’s Representative’s review and comments. Following acceptance, prepare three (3) copies of bound and indexed owner’s manual, to be delivered at the time of final acceptance, which shall include but not be limited to the following:
      a. System operating instructions.
      b. System control drawings.
      c. System interlock drawings.
      d. System maintenance instructions.
      e. Manufacturers’, suppliers, and subcontractors names, addresses, and telephone numbers, both local representatives and manufacturers service headquarters.
      f. Equipment operating and maintenance instructions and parts lists.
      g. Manufacturers’ certifications (see Checking and Testing Materials and/or Equipment, this section).
      h. Contractor’s warranty.
      i. Acceptance certificates of authorities having jurisdiction.
      j. Log of all tests made during course of work.
      k. Owner’s acknowledgment of receipt of instruction, enumerating items in owner’s manual.
      l. List of manufacturers guarantees executed by the Contractor.
      m. Owner’s acknowledgment of items of equipment or accessories indicated or specified to be turned over to Owner.
   4. Instructions:
      a. Verbal, as herein specified.
      b. Posted, framed under glass or plastic laminated:
         1) System operating instructions.
2) System control drawings.
3) System interlock drawings.
5. Record Drawings: Deliver the specified record drawings to the Owner’s Representative.

1.27 RECORD DRAWINGS

A. The Contractor shall maintain a set of contract drawings at the job site on which he shall indicate the installed locations of all equipment, electrical lighting, data drops, fire alarm devices, PA system devices, outlets, and electrical feeders. These drawings shall be used for reference or construction and shall not leave the field office. Upon completion of the work, the Contractor shall obtain and pay for Mylar’s and/or disks (if available as CAD files) of the contract drawings from the Owner’s Representative and transfer the above information to these Mylar’s to provide “Record Drawings.” The above-mentioned prints and “Record Drawings” shall then be delivered to the Owner’s Representative. Refer to paragraph entitled “Record Drawings” of the Supplemental General Conditions.

1.28 ALLOWANCES

A. Refer to Division 1 for allowances.

1.29 ALTERNATE PROPOSALS

A. Alternate proposals are summarized in Division 1 and on the bid proposal form. Refer to all sections of the specifications and the drawings to determine the exact extent and scope of the various alternate proposals as each pertains to the work of the various trades.

1.30 WARRANTY

A. General: All work performed (including equipment and materials furnished) under the various sections of these specifications shall be 100% warranted, for a period of one (1) year from the date of substantial completion thereof, against defective materials, design, and unauthorized substitution. Upon receipt of note of failure of any part of the guaranteed equipment and/or facilities during the guaranty period, the affected part(s) or facilities shall be replaced promptly with new parts, etc. by and at the expense of the Contractor. Further, the Contractor shall properly obtain, execute, and forward any and all manufacturer’s warranties on equipment furnished under the Contract. Refer to Division 1 for additional requirements.

B. Extended Period: The Contractor shall provide all extended time warranties available from the manufacturer of the equipment provided as standard at no additional cost. This includes all extended warranties where specified with certain equipment as directed in other sections of this Specification.
PART 2 - PRODUCTS

2.1 MATERIALS AND WORKMANSHIP

A. All materials, unless otherwise specified, shall be current United States manufacture, new, free from all defects, and of the best quality. Foreign goods specifically approved for use by the Owner’s Representative prior to bidding may be furnished.

B. Materials and equipment shall be installed in accordance with the manufacturer’s recommendations and the best standard practice for the type of work involved. All work shall be executed by electricians skilled in their respective trades, and the installations shall present a neat, precise appearance.

C. The responsibility for the furnishing and intended installation of the proper electrical equipment and/or material as intended rests entirely upon the Contractor. The Contractor shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.

2.2 MATERIAL AND EQUIPMENT REQUIREMENTS

A. Manufacturer’s Instructions: The manufacturer’s published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufacturer materials or equipment, unless otherwise indicated. The Contractor shall promptly notify the Owner’s Representative in writing of any conflict between the requirements of the Contract Documents and the manufacturer’s direction and shall obtain the clarification of the Owner’s Representative before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer’s directions or such clarification by the Owner’s Representative, he shall bear all costs arising in connection with the correction of the deficiencies.

B. Storage at Site: The Contractor shall not receive material or equipment at the jobsite until there is suitable space provided to properly protect equipment from rust, drip, humidity, and dust damage from surrounding work. All new or relocated equipment shall be stored inside or protected from the environment. Equipment that is not properly stored shall be replaced by the contractor at no cost to the owner.

C. Capacities shall be not less than those indicated and shall be such that no component or system becomes inoperative or is damaged because of startup or other overload conditions.

D. Conformance to Agency Requirements: Where materials or equipment are specified to be approved, listed, tested, or labeled by the Underwriters Laboratories, Inc., or constructed and/or tested in accordance with the standards as listed in the NEC, the Contractor shall submit proof that the items furnished under this section of the specifications conform to such requirements. The label of the Underwriters
Laboratories, Inc. applied to the item will be acceptable as sufficient evidence that the items conform to such requirements.

E. Nameplates: Each major component of equipment shall have the manufacturer's name, address, and model-identification number embossed on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Inspection. All equipment starters and disconnects shall be tagged with the equipment designated mark and circuit.

F. Prevention of Rust: Standard factory finish will be acceptable on equipment specified by model number otherwise surfaces of ferrous metal shall be given a rust-inhibiting coating. The treatment shall withstand 200 hours in salt-spray fog test, in accordance with Method 6061 of Federal Standard No. 141. Immediately after completion of the test, the specimen shall show no signs of wrinkling or cracking and no signs of rust creepage beyond 1/8 inch on either side of the scratch mark. Where rust inhibitor coating is specified hereinafter, any treatment that will pass the above test is acceptable unless a specific coating is specified, except that coal tar or asphalt-type coatings will not be acceptable unless so stated for a specific item. Where steel is specified to be hot-dip galvanized, mill-galvanized sheet steel may be used provided all raw edges are painted with a zinc-pigmented paint conforming to Military Specification MIL-P-26915.

G. Protection of Connections: Switches, breaker handles, keys setscrews, handles and other parts not listed for normal occupied operation (light switches, etc.) shall be located accessible to but out of paths to prevent their accidental shutoff.

H. Verifications of Dimensions: The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, to verify all dimensions in the field, and to advise the Owner's Representative of any discrepancy before performing any work. Adjustments to the work required in order to facilitate a coordinated installation shall be made at no additional cost to the Owner, Architect, or Engineer.

I. Standard Products: Materials and equipment to be provided shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications, and shall essentially duplicate materials and equipment that have been in satisfactory use at least two years.

2.3 SUBSTITUTION OF MATERIALS AND EQUIPMENT

A. No substitution of materials or equipment herein specified or called for on the drawings will be permitted, except by written permission of the Owner’s Representative. Where several makes of equipment or material are mentioned, any item named may be bid upon provided it meets space, capacity specifications, finish,
usage (switching, ballasts, similar operation), and looks and functions as what was specified.

B. Do not submit substitutions that do not match in whole what was specified or scheduled. Deviations from scheduled or specified items are installed at the contractor’s risk and are subject to replacement if the owner/engineer deems the product different from the specified item.

C. If the specified item is no longer available, it is the contractor’s responsibility to contact the architect/engineer and notify that the item is not available and suggest a suitable substitution that matches in whole the form, function, and appearance of the scheduled or specified item.

D. Refer to Conditions of the Contract and Division 1 for additional requirements regarding substitutions.

2.4 FLAME SPREAD AND SMOKE DEVELOPED PROPERTIES OF MATERIALS

A. Plenum cable, conduit, insulation, equipment support and mounting hardware, tapes, adhesives, core materials, jackets, and other materials in concealed locations, including any above-ceiling area, shall have a flame spread rating not over 25 without evidence of continued progressive combustion and a smoke developed rating no higher than 50. Flame spread and smoke developed ratings shall be in accordance with NFPA Standard No. 255.

2.5 MOTORS

A. The Contractor shall provide all motors required for equipment supplied under each portion of the work. Motors shall be built in accordance with the latest ANSI, IEE, and NEMA standards, shall be fully coordinated with the equipment served, shall be of sizes and electrical characteristics scheduled.

2.6 STARTING EQUIPMENT

A. Each motor shall be provided with proper starting equipment. This equipment, unless hereinafter specified or scheduled to the contrary, shall be provided by the trade furnishing the motor. All motor starting equipment provided by any one trade shall be of the same manufacture unless such starting equipment is an integral part of the equipment on which the motor is mounted.

2.7 SLEEVES, INSERTS, AND FASTENINGS

A. General: Proper openings through floors, masonry walls, roofs, etc. for the passage of conduits shall be provided. All conduit through floors and walls must pass through sleeves, except conduit that is cast-in-place. Sleeves shall be set in new construction
before concrete is poured, as cutting holes through any part of the concrete will not be permitted unless acceptable to the Owner’s Representative.

B. Materials: Sleeves shall be of standard weight galvanized iron pipe, except heavy-gauge galvanized iron sleeves may be utilized in concrete pours where acceptable to the Owner’s Representative for size and metal gauge. Sleeves in fittings, grade beams, and where pipes enter or leave the building or pass through concrete or masonry shall be Schedule 40 PVC along the pipe route from the underground installation to the insulating coupling installed above ground.

2.8 ACCESS DOORS

A. General: Provide wall, ceiling, or duct access doors for unrestricted access to all concealed items of electrical equipment.

B. Manufacturers shall be Inland-Milcor, Bilco, Miami Carey, or approved equal.

C. UL labeled when in fire-rated construction, one and one-half hour rating.

D. Equipment access doors shall be of sufficient size to remove/replace equipment and provide routine maintenance as necessary, unless otherwise noted. All doors shall have wedge-type latches except where cylinder locks are otherwise indicated or specified. Doors shall be set flush with adjacent finish surfaces. Exterior doors shall be provided with cylinder locks.

E. Access doors into ductwork shall be 14-gauge insulated galvanized steel with 16-gauge galvanized gasketed steel frame and cam-type locks. Access door shall be a minimum of 12" x 12" in size.

2.9 CONDITION OF MATERIALS

A. All materials required for the installation of the electrical systems shall be new and unused. Any material or equipment damaged in transit from the factory, during delivery to premises, while in storage on premises, while being erected and installed, or while being tested, until time of final acceptance, shall be replaced by this Contractor without extra cost to Owner.

PART 3 - EXECUTION

3.1 SPACE AND EQUIPMENT ARRANGEMENTS

A. The size of electrical equipment indicated on the drawings is based on the dimensions of a particular manufacturer. While other manufacturers will be acceptable, it is the responsibility of the Contractor to determine whether the equipment he proposes to
furnish will fit in the space. Shop drawings shall be prepared when required by the Owner’s Representative to indicate a suitable arrangement.

B. All equipment shall be installed in a manner to permit access to all surfaces.

3.2 LARGE APPARATUS

A. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through stairways, doorways, or shafts shall be brought to the job and placed in the space before the enclosing structure is completed. Following placement in the space, such apparatus shall be thoroughly, completely protected from damage as hereinafter specified.

3.3 HOISTING, SCAFFOLDING, AND TRANSPORTATION

A. Provide hoisting and scaffolding facilities as required to set materials and equipment in place.

3.4 PROTECTION

A. The Contractor shall take such precautions as may be necessary to properly protect all materials and equipment from damage from the time of delivery until the completion of work. This shall include the erection of all required temporary shelters and supports to adequately protect any items stored in the open on the site from the weather, the ground and surrounding work; the cribbing of any items above the floor of the construction; and the covering of items in the uncompleted building with tarpaulins or other protective covering. Failure on the part of the Contractor to comply with the above will be sufficient cause for the rejection of the items in question.

B. The Contractor shall protect existing facilities, the work of others, and the premises from any and all damages that may be made possible by the execution of work.

C. Equipment and materials shall be protected from rust both before and after installation. Any equipment or materials found in a rusty condition at the time of final inspection must be cleaned of rust and repainted as specified elsewhere in these specifications.

3.5 COOPERATION BETWEEN TRADES AND WITH OTHER CONTRACTORS

A. Each trade, subcontractor, and/or Contractor must work in harmony with the various trades, subcontractors, and/or Contractors on the job as may be required to facilitate the progress to the best advantage of the job as a whole. Each trade, subcontractor, and/or Contractor must pursue its work promptly and carefully so as not to delay the
general progress of the job. This Contractor shall work in harmony with Contractors working under other contracts on the premises.

B. It shall be the responsibility of each trade to cooperate fully with the other trades on the job to help keep the jobsite in a clean and safe condition. At the end of each day's work, each trade shall properly store all of its tools, equipment, and materials and shall clean its debris from the job. Upon the completion of the job, each trade shall immediately remove all of its tools, equipment, any surplus materials, and all debris caused by its portion of the work.

3.6 PRECEDENCE OF MATERIALS

A. These specifications and the accompanying drawings are intended to cover systems which will not interfere with the structural design of the building, which will fit into the several available spaces, and which will ensure complete and satisfactory systems. Each subcontractor and/or trade shall be responsible for the proper fitting of his material and apparatus into the building.

B. The work of the various trades shall be performed in the most direct and workmanlike manner without hindering or handicapping the work of other trades. Piping interferences shall be handled by giving precedence to pipe lines which require a stated grade for proper operation. Where space requirements conflict, the following order or precedence shall, in general, be observed:

1. Building lines.
2. Structural members.
3. Soil and drain piping.
5. Vent piping.
6. Supply, return, and outside air ductwork.
7. Exhaust ductwork.
8. HVAC water and steam piping.
9. Steam condensate piping.
10. Fire protection piping.
11. Natural gas piping.
12. Domestic water (cold and hot).
13. Refrigerant piping.

3.7 CONNECTIONS FOR OTHERS

A. This Contractor shall rough-in for and make all electrical connections to all fixtures, equipment, machinery, etc. provided by others in accordance with detailed roughing-in drawings provided by the equipment suppliers, by actual measurements of the equipment connections, or as detailed.
B. After the equipment is set in place, this Contractor shall make all final connections and shall provide all required conduit, fittings, whips, connectors, etc.

C. The Mechanical Contractors will set in place, ready for connection, all motors to be provided under their Contracts. The Mechanical Contractors will furnish and deliver all starter and control equipment not shown in motor control centers for any motors which they furnish. The Mechanical Contractor shall be responsible for the complete installation of all automatic temperature control systems, including wire, conduit, and interlocking connections.

D. The Electrical Contractor shall connect all motors and shall set in place all control devices, furnishing supports if and as necessary, and shall furnish and install all interconnecting line voltage wiring and make all connections ready for operation between motors, starters, and disconnect switches, as required. The Electrical Contractor shall furnish and install all motor control centers, including breakers, starters, etc. The Contractor shall refer to the Mechanical drawings and specifications for his scope of the connections to equipment furnished under these Contracts.

3.8 INSTALLATION METHODS

A. Where to Conceal: All conduits shall be concealed in chases, walls, furred spaces, below suspended floors, or above the ceilings of the building unless otherwise indicated. All concealed conduit shall be run in a professional manner, and parallel or perpendicular to the building lines.

B. Where to Expose: In mechanical rooms, only where necessary, conduit may be run exposed. All exposed conduit shall be run in the neatest, most inconspicuous manner, and parallel or perpendicular to the building lines. Conduit shall be bent in a manner as to run parallel to other conduits and not cross at angles.

C. Support: All conduit shall be adequately and properly supported from the building structure by means of hangers or clamps to walls as herein specified.

D. Maintaining Clearance: Where limited space is available above the ceilings and below concrete beams or other deep projections, conduit shall be sleeved through the projection where it crosses, rather than hung below them, in a manner to provide maximum above-floor clearance. Sleeves shall be as herein specified. Approval shall be obtained from the Owner’s Representative for each penetration.

E. All conduits, etc. shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All conduits run exposed in machinery and equipment rooms shall be installed parallel to the building lines. Conduits in furred ceilings and in other concealed spaces may be run at angles to the construction but shall be neatly grouped and racked indicating good workmanship. All conduit openings shall be kept closed until the systems are closed with final connections.
F. Special Requirements:
1. The Contractor shall study all construction documents and carefully lay out all work in advance of fabrication and erection in order to meet the requirements of the extremely limited spaces. Where conflicts occur the Contractor shall meet with all involved trades and the Owner’s Representative and resolve the conflict prior to erection of any work in the area involved.
2. All conduit not directly buried in the ground or installed outside shall be considered as “interior.”
3. Prior to the installation of any ceiling material, gypsum, plaster, or acoustical board, the Contractor shall notify the Owner’s Representative so that arrangements can be made for an inspection of the above-ceiling area about to be “sealed off.” The Contractor shall give as much advance notice as possible up to ten (10) working days, but in no case less than five (5) working days.
4. The purpose of this inspection is to verify the completeness and quality of the installation of the electrical systems and any other special above-ceiling systems, such as data, fire alarm, security. The ceiling supports (tee bar or lath) should be in place so that access panel and light fixture locations are identifiable and so that clearances and access provisions may be evaluated.
5. No ceiling material shall be installed until the deficiencies listed from this inspection have been corrected to the satisfaction of the Owner’s Representative.

3.9 CUTTING AND PATCHING

A. General: Cut and patch walls, floors, etc. resulting from work in existing construction or where made necessary by failure to provide proper openings or recesses in new construction.

B. Methods of Cutting: Openings cut through concrete and masonry shall be made with masonry saws and/or core drills and at such locations acceptable to the Owner’s Representative. Impact-type equipment will not be used except where specifically acceptable to the Owner’s Representative. Openings in concrete for pipes, conduits, outlet boxes, etc. shall be core drilled to exact size. Determine location of embedded conduit and reinforcing bars prior to cutting.

C. Restoration: All openings shall be restored to “as-new” condition under the appropriate specification section for the materials involved, and shall match remaining surrounding materials and/or finishes.

D. Masonry: Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Adequate supports shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc. shall be of the proper size and shape, and shall be installed in a manner acceptable to the Owner’s Representative.
E. Plaster: All mechanical work in area containing plaster shall be completed prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.

F. Weakening: No cutting, boring, or excavating which will weaken the structure shall be undertaken.

3.10 SLEEVES, INSERTS, AND FASTENINGS

A. Sleeves: The minimum clearance between horizontal conduit and sleeve shall be ¼ inch, except that the minimum clearance shall be ½ inch where piping contacts the ground. Sleeves through floors shall extend ¾ inch above the floor; sleeves through walls and partitions shall be installed flush with exposed surfaces. Sleeves are not required for piping indicated to the cast-in-concrete slabs-on-fill.

B. Inserts: Suitable concrete inserts for conduit and equipment hangers shall be set and properly located for all conduit and equipment to be suspended from concrete construction.

C. Fasteners: Fastening of pipes, conduits, etc. in the building shall be as follows:
   1. To wood members: by wood screws.
   2. To masonry and concrete: by threaded metal inserts, metal expansion screws, or toggle bolts, whichever is appropriate for the particular type of masonry or concrete.
   3. To steel: machine screws or welding (when specifically permitted or directed), or bolts.

D. Weatherproofing: The annular space between a conduit and its sleeve in exterior walls or through floor to below grade shall be filled with polyurethane foam rods 50% greater in diameter than the space as backing and fill material and made watertight with a permanent elastic polysulfide compound. Seal both surfaces of wall or floor with a fire-resistant sealant.

3.11 FLOOR AND CEILING PLATES

A. Except as otherwise noted, provide one-piece chrome-plated brass floor and ceiling plates (or escutcheons) around all pipes, conduits, etc. passing through walls, floors, or ceilings in any spaces, except underfloor and attic spaces. Plates shall be sized to fit snugly against the outside of the conduit. Plates will not be required for piping where sleeves extend 2 inches above finish floor and are concealed. Plates shall be one piece.

3.12 FIRE AND SMOKE PARTITION, WALL, AND/OR FLOOR PENETRATIONS
A. Conduit passing through fire- or smoke-rated floors, partitions, walls, or other barriers within a UL-listed assembly which shall maintain the rating of the applicable wall, floor, partition, or barrier. Flexible conduit shall not be used in rated walls. Provide connections between “hard” pipe and flexible whips on either side of wall. Fireproof around conduits.

B. The Contractor shall review the architectural and structural drawings and determine the location of the fire-rated building elements. Where these elements are penetrated, UL-listed fire-rated penetration assemblies approved by the local authority shall be provided in accordance with the manufacturer’s instructions to obtain the required rating.

3.13 CONDUIT SUPPORT

A. Conduit Support: All conduits throughout the building, both horizontal and vertical, shall be adequately supported from the construction to line of grade, with proper provision for expansion, contraction, vibration elimination, and anchorage. Vertical conduits shall be supported from floor lines with riser clamps sized to fit the lines and to adequately support their weight. At the bases of lines, where required for proper support, provide anchor base fittings or other approved supports.

B. Conduit shall not be supported from any other system.

3.14 HANGERS

A. General: Each hanger shall be properly sized to fit the supported pipe or to fit the outside of the insulation on lines where specified.

B. Attachment:
   1. The load on each hanger and/or insert shall not exceed the safe allowable load for any component of the support system, including the concrete which holds the inserts. Reinforcement at inserts shall be provided as required to develop the strength required.
   2. Where pipes are supported under steel beams, approved-type beam clamps shall be used.
   3. Where conduit is supported under wood joists, hanger rods shall be attached to joists with side beam brackets or angle clips.

C. Spacing: All hangers shall be so located as to properly support horizontal lines without appreciable sagging of these lines. All PVC shall be supported at intervals recommended by the manufacturer, or as otherwise specified or indicated.

D. Trapezes: Where multiple lines are run horizontally at the same elevation and grade, they may be supported on trapezes of Kindorf, Elcen, or approved equal, channel-suspended on rods or pipes. Trapeze members including suspension rods shall each
be properly sized for the number, size, and loaded weight of the lines they are to support.

E. Ceiling-Mounted Devices: All lighting and devices or assemblies mounted in lay-in-type ceilings and which are supported by the ceiling grid, directly or indirectly, and which weigh in excess of 2 lbs., shall be provided with at least two 12-gauge minimum wire supports connected securely between the device or assembly and the structure, to serve as a safety support in the event of the collapse of or a disturbance in the support of the ceiling system that might cause the device or assembly to fall through the ceiling. This includes, but is not limited to, light fixtures, J-boxes, and heavy speakers. Provide additional support as required where the weight of the device or assembly will exceed the safe limits of the wire supports.

F. Perforated strap iron or wire will not be acceptable as hanger material.

G. Miscellaneous: Provide any other special foundations, hangers, and supports indicated on the drawings, specified elsewhere herein, or required by conditions at the site. Hangers and supporting structures for suspended equipment shall be provided as required to support the load from the building structure in a manner acceptable to the Owner’s Representative.

3.15 ACCESS DOORS

A. Provide in walls, floors, and ceilings to permit access to all equipment and piping requiring service or adjustment. Examples of such equipment needing access are disconnects, actuators, contacts, and equipment needing periodic or replacement maintenance.

B. Use panels equal to Milcor Style M for masonry and drywall construction, equal to Milcor Style K for plastered masonry walls and ceilings. Stainless steel panels shall be used in ceramic tile or glazed structural tile.

C. Access doors located outside or in a moisture-laden environment (e.g., toilet room, dressing area, shower area, etc.) shall be stainless steel.

3.16 ROOF PENETRATIONS AND FLASHING

A. The contractor shall obtain from the Owner all warranty requirements for new or existing roofing systems and shall have all work on roof penetrations, curbs or equipment supports performed by a subcontractor acceptable to the Owner and the new or existing roofing system installer and manufacturer in order that all roofing system and materials warranties are preserved.

B. Pipe and conduit ducts, pitch pockets, curb bases, and flashing compatible with the roofing installation shall be provided for roof penetrations. Provide framing or other
support around all openings through roof as required to preserve the structural integrity of the roof system and make the penetration weathertight.

C. Roof curbs for all roofs except standing seam metal roofs shall be provided by the equipment supplier supplying the roof-mounted equipment, etc., and such curbs shall be installed by the roofing trades. Contractor shall coordinate all roof curb requirements with all trades and the roofing trades at the earliest possible stage of the project.

D. Roof curbs for standing seam metal roofs shall be provided by the roofing trades. Curb base size, height, and type shall be coordinated with the roofing trades at the earliest possible stage of the project.

E. Flashing for pipe and conduit penetrations of standing seam metal roofs shall be provided and installed by the roofing trades.

F. See Division 7: Thermal and Moisture Protection for metal roof curbs, flashing, etc.

3.17 TESTS AND INSPECTIONS

A. Refer to conditions of the contract and Division 1 for additional requirements regarding tests and inspections.

B. General: The Contractor shall make all tests deemed necessary by the inspection departments of the authority having jurisdiction, Board of Underwriters, etc. He shall provide all equipment, materials, and labor for making such tests. Fuel and electrical energy for system operational tests following beneficial occupancy by the Owner will be paid for by the Owner.

C. Other: Additional tests specified hereinafter under the various specifications sections shall be made.

D. Notification: The Owner’s Representative shall be notified at his office 36 hours prior to each test and other specifications requirements requiring action on the part of the Owner, Architect, Engineer, and/or Owner’s Representative.

E. Test Logs: All tests which the Contractor conducts shall have pertinent data logged by the Contractor at the time of testing. Data shall include date, time, personnel, description and extent of system tested, test conditions, test results, specified results, and any other pertinent data. Data shall be delivered to the Owner’s Representative as specified under “Requirements for Final Acceptance.”

F. Inspections: In general, an inspection by the Owner’s Representative shall be required prior to closing up any work and prior to beneficial occupancy or final project completion. The closing up of work includes, but is not limited to, conduit installations prior to backfilling; electrical and fire protection work prior to placement
of concrete; or closing up walls and overhead electrical and fire protection work prior to installation of the ceiling.

3.18 CLEANING AND PAINTING

A. The contractor shall at all times keep the premises free from accumulations of waste material or rubbish. Debris shall be removed from the site and from any street or alley adjacent to the site.

B. Thoroughly clean and touch up the finish on all parts of the materials and equipment. Exposed parts in equipment rooms, and all other spaces except sealed chases and attics shall be thoroughly cleaned of cement, plaster, and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out.

C. Exposed metal work which is not galvanized shall be carefully brushed down with steel brushes to remove rust and other spots and left smooth and clean and then painted with a suitable rust resistant primer. Exposed metal work includes work exterior to the building; exposed in mechanical or electrical equipment rooms and storage rooms; and other areas where occupants could see the work, whether normally occupied or not.

D. All other painting shall be accomplished under the Painting Section of Division 9 of the specifications.

E. At completion of the project, the Contractor shall remove all tools, scaffolding, and surplus materials. Contractor shall leave the area “broom clean”. Before final acceptance, vacuum all panels, switchboards, starters, and other electrical devices. Wipe clean all fixture lenses and reflectors, all panelboard and switchboard interior and exterior surfaces, being careful to remove all stray paint, construction materials, dust, and particles. Touch-up all marred surfaces to restore existing conditions to those provided by the manufacturer.

3.19 IDENTIFICATION AND LABELING

A. General: The Contractor shall make it possible for the personnel operating and maintaining the equipment and systems in this project to readily identify the various pieces of equipment, disconnects, panels, etc. by marking them. All disconnects/starters/panels shall be labeled for the equipment they serve. Marks shall be the same as the drawings.

3.20 COORDINATION OF WORK

A. The light fixture grid layout as indicated on the drawings must be maintained. This Contractor shall refer to all light fixture plans and details indicated on the drawings.
B. The electrical trades shall locate all junction boxes, pull boxes, conduits, etc. to avoid interference with the diffusers, dampers, grilles, etc. The mechanical trades shall furnish to all other trades copies of approved ductwork shop drawings to assist in the coordination of the rough-in and installation of all items of work.

C. The order of space allocation priority in plan and in elevation shall be as follows.
1. 1<sup>st</sup> Light Fixtures, at Ceiling Soffit + 6”
2. 2<sup>nd</sup> Grade Plumbing Waste and Vent Systems
3. 3<sup>rd</sup> Ductwork
4. 4<sup>th</sup> Pressurized Piping Systems
5. 5<sup>th</sup> Electrical Conduit
6. 6<sup>th</sup> Ceiling Support System, where required

3.21 DISCHARGE OF WASTES FROM CONSTRUCTION SITE

A. The Contractor shall comply with all applicable provisions of local, state, and federal laws regarding the discharge of wastes into sewer and waterways. Special caution shall be exercised to prevent the discharge of wastes which contain oil, tar, asphalt, roofing compound, kerosene, gasoline, paint, mud, cement, lime, or other materials which would degrade the water quality of the receiving water course.

B. Disposal of Lamps and Ballasts: The proper disposal of all ballasts and lamps from the demolition of lighting fixtures as part of this project will be the responsibility of the Electrical Contractor. All lamps and ballasts found to contain hazardous contaminants will be removed from the site and transported to a licensed disposal facility by a contractor licensed in this field. All work shall be performed in accordance with current state and Federal rules and regulations pertaining to the processing of contaminated waste materials. A certificate of proper disposal from the licensed waste contractor shall be provided to the Engineer.

3.22 OPERATING AND MAINTENANCE MANUAL

A. The Contractor shall furnish indexed operating and maintenance manuals with complete technical data for each electrical system, piece of equipment, and material installed under this Contract.

B. The manuals shall be identified on the cover as “Operating and Maintenance Manual” and shall list the name and location of project, the Owner, the Engineers, the General Contractor, and the Subcontractors installing equipment represented in the brochure.

C. Two (2) copies of the manual, bound in three-ring hardback binders shall be provided. One copy shall be completed and delivered to the Engineer prior to the time that system and equipment tests are performed. The second copy shall be delivered prior to final acceptance. The manual shall have a Table of Contents and shall be grouped in tabbed sections according to the specification sections. Each section shall be organized as follows:

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1. Approved engineering submittals with complete performance and technical data.
2. Manufacturer’s local representative and/or distributor’s name and address.
3. Manufacturer’s installation instructions and brochures.
4. Manufacturer’s operating and maintenance brochures.
5. Manufacturer’s installation wiring diagram.
6. Contractor’s field wiring diagram, if different.
7. Manufacturer’s brochure listing recommended spare parts.
8. Manufacturer’s brochure listing replacement part numbers and descriptions.

D. Provide a final section entitled, “Warranties and Guarantees”, for all equipment as well as Contractor’s warranty.

3.23 CONDITIONS OF EQUIPMENT AT FINAL ACCEPTANCE

A. At the time of acceptance, the Contractor shall have inspected all installed systems to assure the following has been completed:
   1. Fixtures are operating, and lenses and reflectors are free of dust, debris, and fingerprints.
   2. Panelboards have all conductors neatly formed, bundled, and made-up tight. Cans shall be vacuum cleaned and surfaces cleaned of stray paint, dust, grease, and fingerprints. All circuit directories to be neatly typed and in place.
   3. Wall plates and exposed switch and receptacle parts to be clean, free of paint, plaster, etc.
   4. Safety and disconnect switches and motor starters to be vacuum cleaned of debris and dust, and all surfaces free of stray paint, grease, and fingerprints.
   5. Switchgear, transformers, and system devices shall be cleaned internally and externally and have all surfaces restored to original surface conditions.
   6. Touch-up all scratched surfaces using paint matching the existing equipment paint. Where paint cannot be matched, the entire surface shall be repainted in a color and manner approved by the Engineer.

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Raceways.
   2. Building wire and connectors.
   4. Electrical demolition.
   5. Cutting and patching for electrical construction.
   6. Touchup painting.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

1.4 SUBMITTALS

A. Not Required.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devised, 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.

B. Comply with NFPA 70.

1.6 COORDINATION

A. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work.
B. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section “Access Doors.”

C. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

D. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

PART 2 - PRODUCTS

2.1 RACEWAYS

A. See Section “Raceways and Boxes.”

2.2 CONDUCTORS

A. See Section “Conductors and Cables.”

2.3 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch-diameter slotted holes at a maximum of 2 inches o.c., in webs.

C. Nonmetallic Channel and Angle Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch-diameter holes at a maximum of 8 inches o.c., in at least one surface.
   1. Fittings and Accessories: Products of the same manufacturer as channels and angles.
   2. Fittings and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.

D. Raceways and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
F. Expansion Anchors: Carbon-steel wedge or sleeve type.

G. Toggle Bolts: All-steel springhead type.


2.4 TOUCHUP PAINT

A. For Equipment: Equipment manufacturer’s paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Dry Locations: Steel materials.

B. Selection of Supports: Comply with manufacturer’s written instructions.

C. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

3.3 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.
B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

F. Install ¼-inch-diameter or larger threaded steel hanger rods, unless otherwise indicated.

G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1½ inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

I. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.

J. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

K. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

L. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
   1. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
   2. Existing Concrete: Expansion bolts.
   3. Steel: Welded threaded studs or spring-tension clamps on steel.
a. Field Welding: Comply with AWS D1.1.
4. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
5. Light Steel: Sheet-metal screws.
6. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.4 FIRESTOPPING

A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division 7 Section “Firestopping.”

3.5 DEMOLITION

A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

C. Remove demolished material from Project site.

D. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.6 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.7 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:
   1. Raceways.
   2. Building wire and connectors.
   4. Electrical identification.
5. Electrical demolition.
6. Cutting and patching for electrical construction.
7. Touchup painting.

3.8 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section “Painting.”
   1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
   2. Follow paint manufacturer’s written instructions for surface preparation and for timing and application of successive coats.
   3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   4. Repair damage paint finishes with matching touchup coating recommended by manufacturer.

3.9 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION
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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 I Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For testing agency.

C. Field Quality-Control Test Reports: From Contractor.

1.4 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.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, all conductors shall be listed for the application, temperature, and insulation rating to which they are intended.

2.2 CONDUCTORS AND CABLES
A. Refer to Part 3 “Conductor and Insulation Applications” Article for insulation type, cable construction, and ratings.

B. Conductor Material:
   1. Copper complying with NEMA WC 5 or 7.
   2. Solid conductors, sizes 10 and 12, uncoated copper per ASTM B3.
   3. Stranded conductor, all other sizes, uncoated copper per ASTM B3, ASTM B787, and ASTM B8.

C. Conductor Insulation Types: Type THHN-THWN and complying with NEMA WC 5 or 7.
   1. Rated for sunlight resistance all colors.
   2. Conductors shall be color coded for voltage and phase as per NEC and any local amendments.
   3. Larger conductors shall have taped color coding.
   4. Size, rating, temperature, and type shall be permanently marked on conductor jacket.
   5. Insulation shall be PVC, heat and moisture resistant, flame retardant compound as per UL-83 and UL-1063.
   6. Jacket shall be polyamide outer nylon covering per UL-83 and UL-1063.

2.3 CONNECTORS

A. Wire Connectors Size 6-14 AWG:
   1. Description: Factory-fabricated UL listed connected and of size, ampacity rating, material, type, and class for application and service indicated.
   2. Provide self-locking square wire spring grab screw on wire connectors sized as per NEC and the number of conductors to be connected.
   3. Thermoplastic deep shell design, with wings on smaller connectors, rated for application temperature, Minimum 105 degrees C.
   4. Copper to copper connection, 600V.
   5. Provide high temp wire connectors for all high temperature equipment applications.

B. Push-in wire connectors are Not Approved and shall not be used for any power or lighting circuits above 50V.

2.4 ALTERNATES

A. Blue Jacketed steel MC Cable is only permitted for 6 foot (maximum) lighting whips. It shall be used for no other purpose.

B. AC cable is not permitted at all.

PART 3 - EXECUTION
3.1 CONDUCTOR AND INSULATION APPLICATIONS

A. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

B. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspace: Type THHN-THWN, single conductors in raceway.

C. Exposed Branch Circuits: Type THHN-THWN, single conductors in raceway.

D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

E. Fire Alarm Circuits: Power-limited, fire-protective, signaling circuit cable.

F. Class 1 Control Circuits: Type THHN-THWN, in raceway.

G. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.2 INSTALLATION

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Minimum line voltage conductor size is #12.

C. Neutrals shall not be shared on any single pole circuit.

D. 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.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Install without damaging conductors/cable, shield, or jacket.
   1. Do not bend conductors/cable, in handling or installation, to smaller radii than minimum recommended by manufacturer.
   2. All new installation cabling shall be one piece without breaks or splices except at device connections.

G. Conductor/Cable extensions if indicated: Provide splices and connectors suitable for the environment and conductors. Each conductor to be individually extended using either pre-insulated in-line connectors or hydraulically crimped butt connectors with 3m Scotchcast™ resin kits to complete the insulation. Connector and insulation shall
be suitable for environment. All splice and tap connectors shall be compatible with cable material. Make no splices except at indicated splice points.

H. Pull conductors/cables without exceeding manufacturer's recommended pulling tensions.
   1. Pull simultaneously if more than one is being installed in same raceway.
   2. Use pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation.
   3. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage media or raceway.

I. Provide pull boxes as per NEC.

J. Provide junction or pull boxes at all splice points.

K. Support cables according to Section “Basic Electrical Materials and Methods.”

L. Seal around cables penetrating fire-rated elements according to Section “Firestopping.”

M. Identify and color-code conductors and cables according to Section “Electrical Identification” and adhere to local color code requirements.

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices 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 and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.4 FIELD QUALITY CONTROL

A. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
   1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
   2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

B. Test Reports: Prepare a written report to record the following:
1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For firms and persons specified in “Quality Assurance” Article.

1.4 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. Comply with UL 467.

B. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Grounding Conductors, Cables, Connectors, and Rods:
      a. Apache Grounding/Erico Inc.
      b. Boggs, Inc.
c. Chance/Hubbell.
d. Copperweld Corp.
e. Dossert Corp.
g. Framatome Connectors/Burndy Electrical.
h. Galvan Industries, Inc.
i. Harger Lightning Protection, Inc.
j. Hastings Fiber Glass Products, Inc.
k. Heary Brothers Lightning Protection, Co.
l. Ideal Industries, Inc.
m. ILSCO.
o. Korns: C.C. Korns Co.; Division of Robroy Industries.
p. Lightning Master Corp.
q. Lyncole XIT Grounding.
r. O-Z/Gedney Co.; a business of the EGS Electrical Group.
s. Raco, Inc.; Division of Hubbell.
t. Robbins Lightning, Inc.
v. Superior Grounding Systems, Inc.
w. Thomas & Betts, Electrical.

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Section “Conductors and Cables.”

B. Material: Copper.

C. Equipment Grounding Conductors: Insulated with green-colored insulation.

2.3 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

2.4 PART 3 - EXECUTION

3.1 APPLICATION

A. In raceways, use insulated equipment grounding conductors.

3.2 EQUIPMENT GROUNDING CONDUCTORS
A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Install equipment grounding conductors in all feeders and circuits.

C. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:
   1. Division 7 Section “Firestopping” for firestopping materials and installation at penetrations through walls, ceilings, and other fire-rated elements.
   2. Section “Basic Electrical Materials and Methods” for supports, anchors, and identification products.
   3. Section “Wiring Devices” for devices installed in boxes and for floor-box service fittings.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

1.4 SUBMITTALS

A. Product Data:
   1. For surface raceways, wireways and fittings.
   2. Floor boxes.
   3. Hinged-cover enclosures and cabinets.

B. Shop Drawings: Show fabrication and installation details of components for raceways, fittings, boxes, enclosures, and cabinets.

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.

B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
   2. Refer to 3.1, RACEWAY APPLICATION, for materials to be used.

2.2 METAL CONDUIT AND TUBING

A. Available Manufacturers:
   1. AFC Cable Systems, Inc.
   2. Alflex, Inc.
   3. Anamet Electrical, Inc.; Anaconda Metal Hose.
   4. Electri-Flex Co.
   5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
   6. Republic Conduit.
   7. Manhattan/CDT/Cole-Flex.
   8. O-Z Gedney; Unit of General Signal.
   9. Wheatland Tube Co.
   10. Perma-Cote
   11. Plasti Bond
   12. KorKap

B. EMT: ANSI C80.3.

C. Fittings: NEMA FB 1; compatible with conduit and tubing materials. Provide fittings factory matched with conduit types.
1. Indoor Fittings: Steel Set Screw or Steel Compression
2. Die cast fittings are not acceptable anywhere.
3. EMT crimp type fittings are not acceptable.

1.4 METAL WIREWAYS

A. Available Manufacturers:
   1. Hoffman.
   2. Square D.

B. Material and Construction: Sheet metal sized and shaped as indicated, NEMA 1.

C. 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.

D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

E. Wireway Covers: Hinged type, or as indicated.

F. Finish: Manufacturer's standard enamel finish.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Available Manufacturers:
   1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
   2. Emerson/General Signal; Appleton Electric Company.
   3. Erickson Electrical Equipment Co.
   6. O-Z/Gedney; Unit of General Signal.
   7. RACO; Division of Hubbell, Inc.
   8. Stahlin
   10. Spring City Electrical Manufacturing Co.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

H. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.6 FACTORY FINISHES

A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.

B. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard paint applied to factory-assembled surface raceways, enclosures, and cabinets before shipping.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Indoors:
   1. Exposed in Mechanical/Electrical/Unfinished Spaces: EMT.
   2. Exposed in Finished Spaces: Metal Surface Raceway painted/finished to match space finishes.
   3. Concealed: EMT.
   4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC.
   5. Boxes and Enclosures: NEMA 250, Type 1.

B. Minimum Raceway Size: 1/2-inch for single 20A or less circuits; otherwise, 3/4-inch trade size.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.
3.2 INSTALLATION

A. Conduit Routing:
   1. All branch circuit conduit shall be run overhead unless specifically directed by the engineer.
      a. Exceptions:
         1) Conduit to floor boxes.
         2) Conduit to locations otherwise inaccessible overhead (exposed or not).
         3) Conduit to column mounted lighting, devices, or equipment inaccessible from above.
   2. All conduit serving any equipment or devices (to include panels, transformers, and switchboards, or any other electrical distribution equipment) within the perimeter of the building shall be run within the perimeter of the building. Conduit shall not run across courtyards or underground from one section of the building to another section of the contiguous building.
   3. All conduit shall be run at right angles or parallel to the building lines to the limits that the structure will allow. Raceways shall not be run diagonal or curved.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Install raceways as high as possible and coordinate installation with other equipment.

D. Install raceways to equipment mounted on the floor away from walls from overhead down to the equipment or disconnects. Do not run across the floor creating a tripping hazard. Rack support conduit at the disconnect.

E. Provide clear access to all pull and j-boxes. Provide access doors over hard (non-lay-in ceilings) to all pull boxes. Minimum access required 1.5 x box cover size or 18 inches.

F. Label all j-box and pull box covers with circuits contained within box.

G. Under no circumstances shall power and data be shared in the same raceway, tray, channel, or sleeve.

H. Install raceways for power conductors (any conductor over 50V) 12 inches from any signal/communications conductor (data, fiber optics, telephone, fire alarm, PA, community antenna and radio distribution (CATV), low power or network powered broadband communications, systems controls, and any other system operating under 50V) not in conduit on J-hooks.

I. Install raceways for power conductors (any conductor over 50V) 12 inches from communications raceways. Communications raceways include; data, fiber optics,
telephone, fire alarm, PA, community antenna and radio distribution (CATV), low power or network powered broadband communications, systems controls, and any other system operating under 50V.

1. Exception: Data and power raceways shall be permitted to be 2 inches apart only at the wall drop to the devices. Above the ceiling or overhead the minimum 12 inch spacing shall be maintained.

2. Exception: Within the surface raceways. When not within the surface raceway, the power and communications raceways shall be 12 inches apart.

J. Complete raceway installation before starting conductor installation.

K. Support raceways as specified in Section “Basic Electrical Materials and Methods.”

L. Install temporary closures to prevent foreign matter from entering raceways during construction. Remove prior to completion of conduit.

M. Sleeves: Provide metallic raceway sleeves through walls or floors for all conductors/cabling not in raceways. Provide bushings at both ends of sleeves prior to installing any conductors or wiring. Firestop as per requirements.

N. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

O. Firestop: Firestop all raceway penetrations in rated walls. Provide intumescent fill in all sleeve openings. Contractor shall be responsible for all wall repair and damage. Excessive firestop for holes too large (½ inch beyond the edge of the raceway) is unacceptable. Holes shall be repaired with suitable wall materials to maintain the integrity of the wall construction.

P. Cut openings in walls as per the outer edges of the raceway. Openings made with hammers or other wall damaging tools are not acceptable. Holes too large (½ inch beyond the edge of the raceway) are unacceptable and shall be repaired with suitable wall materials to maintain the integrity of the wall construction. Contractor shall be responsible for repair to match existing.

Q. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

R. Expansion Joints: Provide flexible connections suitable for use with conduit type for all conduit in structural expansion joints or independent slabs that are within another structural assembly.
S. Raceways Through Slabs to Interior Spaces: Install where practical and leave at least 2 inches from any walls unless required to come up in the wall. Coordinate with grade or perimeter beams prior to installation.
   1. Secure raceways to concrete with conduit clamps.
   2. Change from nonmetallic raceways to rigid steel conduit or IMC before rising above the floor.
      a. Exception: Raceways from below grade into transformers and switchgear enclosures shall be RNC with bushings.
      b. Exception: Raceways from below grade for telephone boards and data/signal equipment shall be RNC with bushings.
   3. Tape conduit from minimum 3 inches below transition to 3 inches above the floor so that no portion of the rigid steel conduit or IMC is in contact with the concrete.

T. Raceways Through Floors: Install where practical and leave at least 2 inches from any walls. Coordinate with grade or perimeter beams prior to installation.
   1. Secure raceways to concrete with conduit clamps.
   2. Provide sleeve seals for conduit penetrations through floors. Provide firestopping at all floor penetrations.

U. Install ALL exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
   1. Run parallel or banked raceways together on common supports.
   2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
   3. Install conduit as high as possible.
   4. Flexible cable or raceway for general circuiting is allowed exposed in mechanical or electrical spaces only. Not allowed in finished spaces.
      a. Exception: As equipment connection only.

V. Join raceways with fittings designed and approved for that purpose and make joints tight.
   1. Use insulating bushings to protect conductors.

W. Tighten set screws of threadless fittings with suitable tools.

X. Terminations:
   1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
   2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
Y. Install pull tape/wires in empty raceways.
   1. For raceways under 2 inches and under less than 100 feet, use polypropylene or
      monofilament plastic line with not less than 200-lb tensile strength. Leave at
      least 12 inches of slack at each end of pull wire.
   2. Raceways under 2 inches and over 100 feet without intermediate pull boxes,
      provide mule tape. With intermediate pull boxes use pull wire.
   3. For raceways over 2 inches and use mule tape.
   4. Sleeves under 36 inches do not require pull tape/wire.

Z. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition
   to above requirements, install raceways in maximum lengths of 150 feet and with a
   maximum of two 90-degree bends or equivalent. Separate lengths with pull or
   junction boxes where necessary to comply with these requirements.

AA. Install raceway sealing fittings at suitable, approved, and accessible locations and fill
   them with UL-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. Label boxes "seal-off". Install raceway sealing fittings at the
   following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of
      refrigerated spaces.
   2. Where otherwise required by NFPA 70.

BB. Stub-up Connections: Extend conduits through concrete floor for connection to
    freestanding equipment. Install with an adjustable top or coupling threaded inside for
    plugs set flush with finished floor. Extend conductors to equipment with rigid steel
    conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated,
    threaded plugs flush with floor for future equipment connections.

CC. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed
    and semi-recessed lighting fixtures if not using MC Cable for lighting whips; for
    equipment subject to vibration, noise transmission, or movement, and for all motors
    indoors of non-water operating equipment. Use LFNC in damp or wet locations or to
    any water operating equipment. Install separate ground conductor across flexible
    connections.

DD. Prime and Paint exposed conduit in finished spaces, unless pre-painted surface
    raceways is provided, as per owner/architect. Provide with paintable surface.

EE. Surface Raceways: Install a separate, green, ground conductor in raceways from
    junction box supplying raceways to receptacle or fixture ground terminals.

FF. Floor Boxes:
   1. Set floor boxes level. Grout around floor box to fill in area around box opening.
   2. Trim after installation to fit flush with finished floor surface.
   3. Ground floor box with circuit grounding conductor.
4. Coordinate covers with floor finishes. Provide covers with inserts for tile or carpet.
5. Floor boxes shall be flush with finish floor.

GG. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

HH. Cap all un-used/spare conduits. Does not include sleeves.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
   1. Provide cover over conduits during storage to prevent dirt and debris from entering conduits during storage.

3.4 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

B. Remove debris from conduits prior to capping any spare conduits.

END OF SECTION
SECTION 26 05 53
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes electrical identification materials and devices required to comply with ANSI C2, NFPA 70, OSHA standards, and authorities having jurisdiction.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Schedule of Nomenclature: An index of electrical equipment and system components used in identification signs and labels.

C. Samples: For each type of label and sign to illustrate color, lettering style, and graphic features of identification products.

1.4 QUALITY ASSURANCE

A. Comply with ANSI C2.

B. Comply with NFPA 70.

C. Comply with ANSI A13.1 and NFPA 70 for color-coding.

PART 2 - PRODUCTS

2.1 RACEWAYS AND CABLE LABELS

A. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

1. Color: Black letters on orange field.

2. Legend: Indicates voltage and service.
B. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl with legend overlaminated with a clear, weather- and chemical-resistant coating.

C. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.

D. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

E. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

F. Aluminum, Wraparound Marker Bands: Bands cut from 0.014-inch- thick aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.

G. Plasticized Card-Stock Tags: Vinyl cloth with preprinted and field-printed legends. Orange background, unless otherwise indicated, with eyelet for fastener.

H. Aluminum-Faced, Card-Stock Tags: Weather-resistant, 18-point minimum card stock faced on both sides with embossable aluminum sheet, 0.002 inch thick, laminated with moisture-resistant acrylic adhesive, punched for fasteners, and preprinted with legends to suit each application.

I. Brass or Aluminum Tags: 2×2×0.05-inch metal tags with stamped legend, punched for fastener.

2.2 NAMEPLATES AND SIGNS


B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
   1. Engraved legend with black letters on white face.
   2. Punched or drilled for mechanical fasteners.

C. Baked-Enamel Signs for Interior Use: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for the application. ¼-inch grommets in corners for mounting.

D. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS

ELECTRICAL IDENTIFICATION – 26 05 53.2
1857
A. Cable Ties: fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.
   2. Tensile Strength: 50 lb minimum.
   3. Temperature Range: Minus 40 to plus 185 deg F.

B. Paint: Formulated for the type of surface and intended use.
   1. Primer for Galvanized Metal: Single-component acrylic vehicle formulated for galvanized surfaces.
   2. Primer for Concrete Masonry Units: Heavy-duty-resin block filler.
   3. Primer for Concrete: Clear, alkali-resistant, binder-type sealer.
   4. Enamel: Silicone-alkyd or alkyd urethane as recommended by primer manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.

C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before applying.

E. Install painted identification according to manufacturer's written instructions and as follows:
   1. Clean surfaces of dust, loose material, and oily films before painting.
   2. Prime surfaces using type of primer specified for surface.
   3. Apply one intermediate and one finish coat of enamel.

F. Color Banding Raceways and Exposed Cables: Band exposed and accessible raceways of the systems listed below:
   1. Bands: Pretensioned, wraparound plastic sleeves; colored adhesive tape; or a combination of both. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

3. Apply the following colors to the systems listed below:
   e. Mechanical and Electrical Supervisory System: Green and blue.
   f. Telecommunication System: Green and yellow.

G. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.

H. Circuit Identification Labels on Boxes: Install labels externally.
   1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
   3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.
   4. Normal Power Circuits: Black lettering and numbers

I. Color-Coding of Secondary Branch Circuit Conductors: Use the following colors for service, feeder, and branch-circuit branch circuit conductors:
   1. 120/208V 3 Phase Conductors:
      a. Phase A: Black.
      b. Phase B: Red.
      c. Phase C: Blue.
      e. Ground: Green.
   2. 277/480V 3 Phase Conductors:
      a. Phase A: Purple.
      b. Phase B: Brown.
      c. Phase C: Yellow.
      d. Neutral: Gray.
      e. Ground: Green.
   3. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:
      a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 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. Use 1-inch-wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
      b. Colored cable ties applied in groups of three ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal.
and spaced 3 inches apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.

J. Power-Circuit Identification: Metal tags or aluminum, wraparound marker bands for cables, feeders, and power circuits in vaults, pull and junction boxes, manholes, and switchboard rooms.
1. Legend: ¼-inch steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
2. Tag Fasteners: Nylon cable ties.

K. Apply identification to conductors as follows:
1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.

L. Apply warning, caution, and instruction signs as follows:
1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

M. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide a single line of text with ½-inch high lettering on 1½-inch-high label; where two lines of text are required, use labels 2 inches high. Use white lettering on black field. Apply labels for each unit of the following categories of equipment using mechanical fasteners:
1. Panelboards, electrical cabinets, and enclosures.
2. Access doors and panels for concealed electrical items.
3. Disconnect switches.
4. Enclosed circuit breakers.
5. Motor starters.
7. Contactors.
8. Dimmers.

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. Indoor occupancy sensors.
   2. Lighting contactors.

B. Related Requirements:

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Contractor to submit entire lighting control system shop drawings showing locations of devices, coverage areas delineated with contour style lines, power pack or controller locations, connections, photocells and locations, and control wiring required.
   1. Show installation details for occupancy and light-level sensors.
   2. Interconnection diagrams showing field-installed wiring.
   3. Include diagrams for power, signal, and control wiring.
   4. Sensors shall overlap in coverage areas requiring multiple sensors.

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 ROOM CONTROLLER: Manufacturers standard complete assembly in one enclosure rated for location. Unit shall contain controls, connections, relays, and wiring.

A. The following features:
   1. Individual control of each switch leg (zone). See floor plan for number of zones. Provide minimum 1 zones with one spare.
   2. Zone control relay fails closed.
   3. Occupancy sensor input.
   5. Capable of network (Owner) controllable.
   6. Zones capable of either vacancy occupancy operation.

B. Provide factory matched to room controller switching of each zone with either pushbutton backlit touch screen or digital wall switching of each zone. See floor plan for type.

2.2 CEILING MOUNTED OCCUPANCY SENSORS

A. 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:
   1. Cooper Industries, Inc.
   2. Hubbell Building Automation, Inc.
   3. Leviton Manufacturing Co., Inc.
   4. Lithonia Lighting; Acuity Brands Lighting, Inc.
   5. Lutron Electronics Co., Inc.
   6. NSi Industries LLC; TORK Products.
   7. Sensor Switch, Inc.
   8. Square D.

B. General Requirements for Sensors: Ceiling-mounted, 360 degree, 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: Turn lights on or enable wall manual switch 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 30 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 load at 120- and 277-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: Internal dry contact closure for SPDT.
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.
9. Dimming output to control 0-10 VDC.
10. Provides second occupancy time out period enabling lighting to go dim prior to off.
11. Adjustable maximum minimum.
12. Can be series or parallel connected.
13. Photo Cell:
   a. Auto set point
   b. On/Off mode during occupancy
   c. Dimming control

C. Standard 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 15 ft. radius when mounted on a 108-inch high ceiling.

D. Extended Range Dual-Technology Type: Ceiling Mounted
   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 28 ft. radius when mounted on a 108-inch high ceiling.

2.3 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. 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:
B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Bryant Electric.
   2. Cooper Industries, Inc.
   3. Hubbell Building Automation, Inc.
   4. Leviton Manufacturing Co., Inc.
   5. Lightolier Controls.
   6. Lithonia Lighting; Acuity Brands Lighting, Inc.
   7. Lutron Electronics Co., Inc.
   8. NSi Industries LLC; TORK Products.
   9. RAB Lighting.
   10. Sensor Switch, Inc.
   11. Square D.
   12. Watt Stopper.

C. 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.

D. Wall-Switch Sensor:
   1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 2100 sq. ft (196 sq. m).
   2. Sensing Technology: Dual technology - PIR and ultrasonic.
   3. Switch Type: SP. SP, field selectable automatic "on," or manual "on" automatic "off."
   4. Voltage: Dual voltage, 120 and 277 V.
   5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
   6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
   7. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
   8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
   9. Programmable for occupancy or vacancy mode.

2.4 HIGH-BAY OCCUPANCY SENSORS

A. 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:
B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Hubbell Building Automation, Inc.

C. General Description: Solid-state unit. The unit is designed to operate with the lamp and ballasts indicated.
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Operation: Turn lights on when coverage area is occupied, and to half-power when unoccupied; with a time delay for turning lights to half-power that is adjustable over a minimum range of 1 to 16 minutes.
   3. Continuous Lamp Monitoring: When lamps are dimmed continuously for 24 hours, automatically turn lamps on to full power for 15 minutes for every 24 hours of continuous dimming.
   4. Operating Ambient Conditions: 32 to 149 deg F (0 to 65 deg C).
   5. Mounting: Threaded pipe.
   6. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
   7. Detector Technology: PIR.
   8. Power and dimming control from the lighting fixture ballast that has been modified to include the dimming capacitor and MyzerPORT option.

D. Detector Coverage: User selectable by interchangeable PIR lenses, suitable for mounting heights from 12 to 50 feet (3.7 to 15.2 m).

E. Accessories: Obtain manufacturer's installation and maintenance kit with laser alignment tool for sensor positioning and power port connectors.

2.5 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements. Products that may be incorporated into the Work include, but are not limited to, the following:
   2. ASCO Power Technologies, LP.
   5. Square D.

B. Description: Electrically operated and electrically held, combination-type lighting contactors with nonfused disconnect, complying with NEMA ICS 2 and UL 508.
   1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
   2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
4. Provide with integral H-O-A switch unless one switch operates multiple contactor cabinets.

C. Interface with DDC System for HVAC: Provide hardware interface to enable the DDC system for HVAC to monitor and control lighting contactors.
   2. Control: On-off operation, relay.
   3. See drawings for operation.

2.6 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 "Conductors and Cables."
B. Classes 2 and 3 Control Cable: Plenum rated, multiconductor cable with stranded-copper conductors.
C. Class 1 Control Cable: Plenum rated, multiconductor cable with stranded-copper conductors.
D. All exterior or underground cabling shall be rated for location.

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.
C. Provide factory representative to locate and calibrate daylight sensors (both stand-alone and integral to fixture) for daylight harvesting (dimming). Verify operation and document settings.
D. Contractor to verify all sensors intended operation and calibrate sensor field of view and sensitivity.
E. Coordinate with owner for occupancy/vacancy sensor delay times.
3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

B. Mount cabinet to wall or unistrut frame.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Section “Control/Signal Transmission Media.” 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.

3.4 ROOM CONTROLLER INSTALLATION

A. Room Controller:
   1. Coordinate switch/touch pad location in room.
   2. Locate room controller above ceiling in accessible location.
   3. Provide plenum rated control cable to each device(s).
   4. Provide above ceiling switch.

3.5 IDENTIFICATION

A. Identify components and power and control wiring according to "Electrical Identification."
   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.

3.6 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. 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.
   3. Verify emergency lighting automatic switchover to generator power at all UL 924 rated light fixture locations.
   4. Verification of sensor operation
      a. Sensor turns lighting on/off at programmed times
      b. Sensor automatically dims lighting
      c. Sensor enables additional switching
      d. Sensor works during emergency lighting generator operation with automatic changeover

C. Lighting control devices will be considered defective and replaced with new if they do not pass tests and inspections.

D. Prepare a written report to be sent to the engineer for review indicating the following:
   1. Room Number
   2. Sensor Type (wall, ceiling, occupancy vacancy, daylighting)
   3. Delay time
   4. Operation Verification (Yes/No)

3.7 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. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.8 DEMONSTRATION

A. Coordinate demonstration of products with Owner prior to substantial completion.

B. Engage a factory-authorized service representative to 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   2. Integrated, multipreset, modular dimming controls.
   3. Multichannel, remote-controlled dimmers.

B. Related Sections include Section “Wiring Devices” for wall-box dimmers and manual light switches.

1.3 SUBMITTALS

A. Product Data: Include dimensions and data on features, components, and ratings for dimming controls. Include elevation views of front panels of control and indicating devices and control stations. Also include the following:
   1. List of ballasts/driver and lamp combinations compatible with dimmer controls, by manufacturer and catalog number.
   2. Sound data, including results of operational tests of dimming controls.
   3. Operational documentation for software and firmware.

B. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on Project. Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
   1. Wiring Diagrams: Detail specific systems tailored to this Project and differentiate between manufacturer-installed and field-installed wiring.

C. Samples: Flush-mounted, dimming control station faceplates for color selection and evaluation of technical features.

D. Manufacturer Certificates: Signed by manufacturers certifying that they comply with requirements.
E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

F. Maintenance Data: For dimming controls to include in maintenance manuals specified in Division 1. Include software operating manuals.

G. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain dimming controls from a single source with total responsibility for compatibility of lighting control system components specified in this Section, in Division 13 Section "Lighting Controls," and in Division 16 Section "Lighting Control Devices."

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for their indicated use and installation conditions by a testing agency acceptable to authorities having jurisdiction.

C. Comply with 47 CFR 15, Subparts A and B, for Class A digital devices.

D. Comply with NFPA 70.

1.5 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Two (2) years from date of Substantial Completion.

1.6 EXTRA MATERIALS

A. Furnish extra products described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra products to Owner.
   1. Dimmer Modules: One (1) for every 10 of each type and rating installed. Furnish at least one (1) of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Products: Subject to compliance with requirements, provide products by one of the following:
   1. Crestron Electronics, Inc.
   2. Diversified Electronics, Inc.
   3. Leviton.
   4. Lightolier.
   5. Lithonia Control Systems.
   7. Sterner Lighting Systems, Inc.
   8. Strand Lighting.
   9. Sensor Switch/nLight

2.2 GENERAL DIMMING DEVICE REQUIREMENTS

A. Line-Voltage Surge Protection: Include in all 120- and 277-V solid-state equipment. Comply with UL 1449 and with ANSI C62.41 for Category A locations.

B. Compatibility: Dimming control components shall be compatible with other elements of interconnected lighting controls and with connected loads as to communication, signaling, and control functions.

C. Dimmers and Dimmer Modules: Comply with UL 508.
   1. Audible Noise and Radio-Frequency Interference Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or radio-frequency interference at any setting. Modules shall include integral or external filters to suppress audible noise and radio-frequency interference.
   2. Dimmer or Dimmer-Module Rating: As indicated, but not less than 125 percent of connected load.

D. Panic Switch: Include where indicated or required by authorities having jurisdiction. Switch operation overrides dimmer settings and restores lights on connected output circuits to full brightness regardless of settings.

2.3 MANUAL, MODULAR DIMMING CONTROLS

A. Description: Factory-fabricated equipment providing one to four channels of manual dimming control. Integrate controls and dimmers for mounting in a two- or three-gang wall box under a single wall plate.

B. Module Dimming Capability: Listed for control of type of lighting unit used.
   1. Unit Rating: 1900 W, minimum; with each dimming channel rated 600 W, minimum.
   2. Wall-Plate Style and Finish: Coordinated with lighting controls specified in other Division 13 and Division 16 Sections.
2.4 DIMMING POWER PACK

A. Provide dimming power pack for each room having dimming fixtures. Each power pack shall have the following features:
   1. Rated for the VA of the fixtures on circuit, minimum 3 kVA.
   2. Full dimming ballast capable of controlling all fixtures on the circuit.
   3. DC output to dimming controller; capable of modulating fixture load output based upon DC input.
   4. Voltage: 120 or 277 as indicated on lighting circuit drawings.
   5. Advance Mark VII (or approved equal).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment level and plumb and according to manufacturer's written instructions.

B. Mount control equipment according to manufacturer's written instructions and requirements in Section “Basic Electrical Materials and Methods.”

C. Mounting heights indicated are to bottom of unit for suspended items and to center of unit for wall-mounting items.

3.2 CONTROL WIRING INSTALLATION

A. Install wiring as specified in Section “Conductors and Cables” for low-voltage connections and Division 16 Section “Voice and Data Systems” for digital circuits.

B. Wiring Method: Install all wiring in raceway as specified in Section “Raceways and Boxes.”

C. Wiring Method: Install all wiring in raceway as specified in Section “Raceways and Boxes,” unless run in accessible ceiling space and gypsum board partitions.

D. Bundle, train, and support wiring in enclosures.

E. Ground equipment.

F. Connections: 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.
3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Section “Electrical Identification.”

B. Label each system control module and each remote dimmer bank with a unique designation. Make designations on elevated components readable from floor.

3.4 FIELD QUALITY CONTROL

A. Manufacturer’s Field Services: Engage a factory-authorized service representative to test, adjust, and program dimming controls.

B. Schedule visual and mechanical inspections and electrical tests with at least seven days' advance notice.

C. Inspect control components for defects and physical damage, testing laboratory labeling, and nameplate compliance with the Contract Documents.

D. Check tightness of electrical connections with torque wrench calibrated within previous six months. Use manufacturers recommended torque values.

E. Verify settings of photoelectric devices with photometer calibrated within previous six months.

F. Electrical Tests: Use particular caution when testing devices containing solid-state components. Perform the following according to manufacturer's written instructions:

1. Continuity tests of circuits.
2. Operational Tests: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
   a. Include testing of dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.

G. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.

H. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.

I. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

3.5 CLEANING
A. Cleaning: Clean equipment and devices internally and externally using methods and materials recommended by manufacturers, and repair damaged finishes.

3.6 DEMONSTRATION

A. Coordinate with training for low-voltage, programmable lighting control system specified in Division 13 Section “Lighting Controls.”

B. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:
   1. Train Owner's maintenance personnel on troubleshooting, servicing, adjusting, and maintaining equipment and schedules. Provide a minimum of two four-hour sessions on separate days for training. Use both classroom training and hands-on exercises.
   2. Training Aid: Use the approved final version of maintenance manuals as a training aid.
   3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

3.7 ON-SITE ASSISTANCE

A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide up to three Project site visits, when requested, to adjust light levels, make preset scene changes, and adjust controls to suit actual conditions.

END OF SECTION
SECTION 26 09 43
NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes a networked lighting control system comprised of the following components:
   1. System Software Interfaces
      a. Management Interface
      b. Visualization Interface
      c. Personal Control Applications
   2. System Backbone and Integration Equipment
      a. System Controller
   3. Wired Networked Devices
      a. Wall Stations
      b. Graphic Wall Stations
      c. Auxiliary Input/Output Devices
      d. Occupancy and Photocell Sensors
      e. Wall Switch Sensors
      f. Power Packs and Secondary Packs

B. The networked lighting control system shall meet all the characteristics and performance requirements specified herein.

C. The contractor shall provide, install and verify proper operation of all equipment necessary for proper operation of the system as specified herein and as shown on applicable drawings.

1.2 RELATED DOCUMENTS

A. Section 26 27 26 Wiring Devices

B. Section 26 09 23 Lighting Control Devices

C. Section 26 51 00 Interior Lighting

1.3 SUBMITTALS

A. Submittal shall be provided including the following items.
   1. Bill of Materials necessary to install the networked lighting control system.
   2. Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.
3. Risers Diagrams showing device wiring connections of system backbone and typical per room/area type.
4. Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.
5. Other Diagrams and Operational Descriptions – as needed to indicate system operation or interaction with other system(s).
6. Contractor Startup/Commissioning Worksheet (must be completed prior to factory start-up).
7. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.
8. Hardware and Software Operation Manuals.

1.4 APPROVALS

A. Prior approval from owner’s representative is required for products or systems manufactured by companies not specified in the Network Lighting Controls section of this specification.

B. Any alternate product or system that has not received prior approval from the owner’s representative at least 10 days prior to submission of a proposal package shall be rejected.

C. Alternate products or systems require submission of catalog datasheets, system overview documents and installation manuals to owner’s representative.

1.5 QUALITY ASSURANCE

A. Product Qualifications
   1. System electrical components shall be listed or recognized by a nationally recognized testing laboratory (e.g., UL, ETL, or CSA) and shall be labeled with required markings as applicable.
   2. System shall be listed as qualified under DesignLights Consortium Networked Lighting Control System Specification V2.0.
   3. System luminaires and controls are certified by manufacturer to have been designed, manufactured and tested for interoperability.
   4. All components shall be subjected to 100% end of line testing prior to shipment to the project site to ensure proper device operation.
   5. All components and the manufacturing facility where product was manufactured must be RoHS compliant.

B. Installation and Startup Qualifications
   1. System startup shall be performed by qualified personnel approved or certified by the manufacturer.

C. Service and Support Requirements
1. Phone Support: Toll free technical support shall be available.
2. Remote Support: The bidder shall offer a remote support.
3. Onsite Support: The bidder shall offer onsite support.

1.6 PROJECT CONDITIONS

A. Only install indoor equipment after the following site conditions are maintained:
   1. Ambient Temperature: 14 to 105 degrees F (-10 to 40 degrees C)
   2. Relative Humidity: less than 90% non-condensing

B. Equipment shall not be subjected to dust, debris, moisture, or temperature and humidity conditions exceeding the requirements indicated above or as marked on the product, at any point prior to installation.

C. Only properly rated equipment and enclosures, installed per the manufacturer’s instructions, may be subjected to dust and moisture following installation.

1.7 WARRANTY

A. The manufacturer shall provide a minimum five-year warranty on all hardware devices supplied and installed. Warranty coverage shall begin on the date of shipment.

B. The hardware warranty shall cover repair or replacement any defective products within the warranty period.

1.8 MAINTENANCE & SUSTAINABILITY

A. The manufacturer shall make available to the owner new parts, upgrades, and/or replacements available for a minimum of 5 years following installation.

PART 2 - EQUIPMENT

2.1 MANUFACTURERS

A. Acceptable Manufacturers
   1. Acuity Brands Lighting, Inc.

B. Basis of Design System: Acuity Controls nLight

2.2 SYSTEM COMPLIANCE

A. System components shall comply with UL 916 and UL 924 standards where applicable.
B. System components shall comply with CFR Title 47, Part 15 standards where applicable.

C. All equipment shall be installed and connected in compliance with NFPA 70.

2.3 SYSTEM PERFORMANCE REQUIREMENTS

A. System Architecture

1. System shall have an architecture that is based upon three main concepts: (1) networkable intelligent lighting control devices, (2) standalone lighting control zones using distributed intelligence, (3) optional system backbone for remote, time based and global operation.

2. Intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, contact closure input, analog 0-10V input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.

3. System must be capable of interfacing directly with networked luminaires such that either low voltage network cabling or wireless RF communication is used to interconnect networked luminaires with control components such as sensors, switches and system backbone (see Control Zone Characteristics sections for each type of network connection, wired or wireless).

4. Networked luminaires and intelligent lighting control devices shall support individual (unique) configuration of device settings and properties, with such configuration residing within the networked luminaires and intelligent control devices.

5. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices and shall be capable of providing automatic control from sensors (occupancy and/or photocell) and manual control from local wall stations without requiring connection to a higher-level system backbone; this capability is referred to as “distributed intelligence.”

a. Lighting control zones (wired and wireless) of at least 128 devices per zone shall be supported.

6. Networked luminaires and intelligent lighting control devices shall have distributed intelligence programming stored in non-volatile memory, such that following any loss of power the lighting control zones shall operate according to their defined default settings and sequence of operations.

7. Lighting control zones shall be capable of being networked with a higher-level system backbone to provide time based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software interface.
8. The system may include one or more system controllers that provide time-based control. The system controller also provides a means of connecting the lighting control system to a system software interface and building management systems via BACnet/IP or BACnet MS/TP protocol.

9. All system devices shall support firmware update, either remotely or from within the applications space, for purposes of upgrading functionality at a later date.

B. Wired Networked Control Zone Characteristics

1. Connections to devices within a wired networked lighting control zone and to backbone components shall be with a single type of low voltage network cable, which shall be compliant with CAT5e specifications or higher. To prevent wiring errors and provide cost savings, the use of mixed types of low voltage network cables shall not be permitted.

2. Devices in an area shall be connected via a “daisy-chain” topology; requiring all individual networked devices to be connected back to a central component in a “hub-and-spoke” topology shall not be permitted, so as to reduce the total amount of network cable required for each control zone.

3. System shall provide the option of having pre-terminated plenum rated low voltage network cabling supplied with hardware so as to reduce the opportunity for improper wiring and communication errors during system installation.

4. Following proper installation and provision of power, all networked devices connected together with low voltage network cable shall automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g. software application, handheld remote, pushbutton). The “out of box” default sequence of operation is intended to provide typical sequence of operation so as to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.

5. Once software is installed, system shall be able to automatically discover all connected devices without requiring any provisioning of system or zone addresses.

6. All networked devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.

7. Networked control devices intended for control of egress and/or emergency light sources shall not require the use of additional, externally mounted UL924 shunting and/or 0-10V disconnect devices, so as to provide a compliant sequence of operation while reducing the overall installation and wiring costs of the system. The following types of wired networked control devices shall be provided for egress and/or emergency light fixtures:
a. Low-Voltage power sensing: These devices shall automatically provide 100% light level upon detection of loss of power sensed via the low voltage network cable connection.

b. UL924 Listed Line-Voltage power sensing: These devices shall be listed as emergency relays under the UL924 standard, and shall automatically close the load control relay and provide 100% light output upon detection of loss of power sensed via line voltage connection to normal power.

8. Networked luminaires and intelligent lighting control devices located in different areas shall be able to transmit and track information within at least 128 system-wide control zones to support required sequences of operation that may span across multiple areas. Occupancy and photocell commands shall be available across a single controller, and switch commands shall be available across single or multiple controllers. These shall also be referred to as global control zones.

9. Wired networked Wall stations shall provide the follow Scene Control Capabilities:
   a. Preset Scenes that can activate a specific combination of light levels across multiple local and global channels, as required.
   b. Profile Scenes that can modify the sequence of operation for the devices in the area (group) in response to a button press. This capability is defined as supporting “Local Profiles” and is used to dynamically optimize the occupant experience and lighting energy usage. Wall stations shall be able to manually start and stop Local Profiles, or the local profile shall be capable of ending after a specific duration of time between 5 minutes and 12 hours. Parameters that shall be configurable and assigned to a Local Profile shall include, but not be limited to, fixture light level, occupancy time delay, response to occupancy sensors (including enabling/disabling response), response to daylight sensors (including enabling/disabling response), and enabling/disabling of wall stations.
   c. 3-way / multi-way control: multiple wall stations shall be capable of controlling the same local and global control zones, so as to support “multi-way” preset scene and profile scene control.

C. System Integration Capabilities

1. The system shall interface with third party building management systems (BMS) to support two-way communication using the industry standard BACnet/IP or BACnet MS/TP protocols. The following system integration capabilities shall be available via BACnet/IP and BACnet MS/TP protocols:
   a. The system shall support control of individual devices, including, but not limited to, control of relay and dimming output.
b. The system shall support reading of individual device status information. The available status will depend on the individual device type and capabilities, which may include but not be limited to, relay state, dimming output, power measurement, occupancy sensor status, and photocell sensor states or readings. All system devices shall be available for polling for devices status.

c. The system shall support activation of pre-defined system Global Profiles (see Supported Sequence of Operations for further definition of Global Profile capabilities).

2. The system shall support activation of Global Profiles from third party systems by receiving dry contact closure output signals or digital commands via RS-232/RS-485. (See Supported Sequence of Operations for further definition of Profile and Scene Preset capabilities.)

3. The system shall support activation of demand response levels from Demand Response Automation Servers (DRAS) via the OpenADR 2.0a protocol.

D. Supported Sequence of Operations

1. Control Zones
   a. Networked luminaires and intelligent lighting control devices installed in an area (also referred to as a group of devices) shall be capable of transmitting and tracking occupancy sensor, photocell sensor, and manual switch information within at least 48 unique control zones to support different and reconfigurable sequences of operation within the area. These shall also be referred to as local control zones.

2. Wall station Capabilities
   a. Wall stations shall be provided to support the following capabilities:
      1) On/Off of a local control zone.
      2) Continuous dimming control of light level of a local control zone.
   b. 3-way / multi-way control: multiple wall stations shall be capable of controlling the same local control zones, so as to support “multi-way” switching and/or dimming control.

3. Occupancy Sensing Capabilities
   a. Occupancy sensors shall be configurable to control a local zone.
   b. Multiple occupancy sensors shall be capable of controlling the same local zones. This capability combines occupancy sensing coverage from multiple sensors without consuming multiple control zones.
   c. System shall support the following types of occupancy sensing sequence of operations:
      1) On/Off Occupancy Sensing
      2) Partial-On Occupancy Sensing
      3) Partial-Off Occupancy Sensing
      4) Vacancy Sensing (Manual-On / Automatic-Off)
d. On/Off, Partial-On, and Partial-Off Occupancy Sensing modes shall function according to the following sequence of operation:

1) Occupancy sensors shall automatically turn lights on to a designated level when occupancy is detected. To support fine tuning of Partial-On sequences the designated occupied light level shall support at least 100 dimming levels.

2) Occupancy sensors shall automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. To support fine tuning of Partial-Off sequences the designated unoccupied dim level shall support at least 100 dimming levels.

3) To provide additional energy savings the system shall also be capable of combining Partial-Off and Full-Off operation by dimming the lights to a designated level when vacant and then turning the lights off completely after an additional amount of time.

4) Photocell readings, if enabled in the Occupancy Sensing control zone, shall be capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary to further reduce energy usage. Additional requirements and details for photocell sensing capabilities are indicated under Photocell Sensing Capabilities.

5) The use of a wall station shall change the dimming level or turn lights off as selected by the occupant. The lights shall optionally remain in this manually-specified light level until the zone becomes vacant; upon vacancy the normal sequence of operation, as defined above, shall proceed.

e. Vacancy Sensing mode (also referred to as Manual-On / Automatic-Off) shall function according to the following sequence of operation:

1) The use of a wall station is required turn lights on. The system shall be capable of programming the zone to turn on to either a designated light level or the previous user light level. Initially occupying the space without using a wall station shall not result in lights turning on.

2) Occupancy sensors shall automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. To support fine tuning of Partial-Off sequences the designated unoccupied dim level shall support at least 100 dimming levels.

3) To provide additional energy savings and an enhanced occupant experience, the system shall also be capable of dimming the lights when vacant and then turning the lights off completely after an additional amount of time.
4) To minimize occupant impact in case the area or zone is still physically occupied following dimming or shut off of the lights due to detection of vacancy, the system shall support an “automatic grace period” immediately following detection of vacancy, during which time any detected occupancy shall result in the lights reverting to the previous level. After the grace period has expired, the use of a wall station is required to turn lights on.

5) Photocell readings, if enabled in the Occupancy Sensing control zone, shall be capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary to further reduce energy usage. Additional requirements and details for photocell sensing capabilities are indicated under Photocell Sensing Capabilities.

6) At any time, the use of a wall station shall change the dimming level or turn lights off as selected by the occupant. The lights shall optionally remain in this manually-specified light level until the zone becomes vacant; upon vacancy the normal sequence of operation, as defined above, shall proceed.

f. To accommodate diverse types of environments, occupancy time delays before dimming or shutting off lights shall be specifiable for control zones between 15 seconds to 2 hours.

4. Photocell Sensing Capabilities (Automatic Daylight Sensing)
   a. Photocell sensing devices shall be configurable to control a local zone.
   b. The system shall support the following type of photocell-based control:
      1) Continuous Dimming: The control zone automatically adjusts its dimming output in response to photocell readings, such that a minimum light level consisting of both electric light and daylight sources is maintained at the task. The photocell response shall be configurable to adjust the photocell setpoint and dimming rates.

5. Schedule and Global Profile Capabilities
   a. The system shall be capable of automatically modifying the sequence of operation for selected devices in response to any of the following: a time-of-day schedule, contact closure input state, manually triggered wired wall station input, RS-232/RS-485 command to wired input device, and BACnet input command. This capability is defined as supporting “Global Profiles” and is used to dynamically optimize the occupant experience and lighting energy usage.
   b. Global profiles may be scheduled with the following capabilities:
1) Global Profiles shall be stored within and executed from the system controller (via internal timeclock) such that a dedicated software host or server is not required to be online to support automatic scheduling and/or operation of Global Profiles.

2) Global Profile time of day schedules shall be capable of being given the following recurrence settings: daily, specific days of week, every “n” number of days, weekly, monthly, and yearly. Lighting control profile schedules shall support definition of start date, end date, end after “n” recurrences, or never ending. Daylight savings time adjustments shall be capable of being performed automatically, if desired.

3) Global Profile Holiday Schedules should follow recurrent settings for specific US holiday dates regardless if they always occur on a specific date or are determined by the day/week of the month.

4) Global Profiles shall be capable of being scheduled to run according to timed offsets relative to sunrise or sunset. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.

5) System shall support blink warning and timed extension capabilities. At the end of a scheduled period, the system shall be capable of providing a visible “blink warning” 5 minutes prior to the end of the schedule. Wall stations may be programmed to provide timed overrides that turn the lights on for an additional period of time. Timed override duration shall be programmable for each individual device, zone of devices, or customized group of devices, ranging from 5 minutes to 12 hours.

6) Software management interface shall be capable of displaying a graphic calendar view of profile schedules for each control zone.

c. System Global Profiles shall have the following additional capabilities:

1) Global Profiles shall be capable of being manually activated directly from the system controller, specially programmed wired input devices, scene capable wired wall stations, and the software management interface.

2) Global Profiles shall be selectable to apply to a single device, zone of devices, or customized group of devices.
3) Parameters that shall be configurable and assigned to a Global Profile shall include, but not be limited to, fixture light level, occupancy time delay, response to occupancy sensors (including enabling/disabling response), response to daylight sensors (including enabling/disabling response), and enabling/disabling of wall stations.

d. A backup of Local and Global Profiles shall be stored on the software’s host server such that the Profile backup can be applied to a replacement system controller or wired wall station.

6. System shall support automated demand response capabilities with automatic reduction of light level to at least three levels of demand response.

2.4 SYSTEM SOFTWARE INTERFACES

A. Management Interface

1. System shall provide a web-based management interface that provides remote system control, live status monitoring, and configuration capabilities of lighting control settings and schedules.

2. Management interface must be compatible with industry-standard web browser clients, including, but not limited to, Microsoft Internet Explorer®, Apple Safari®, Google Chrome®, Mozilla Firefox®.

3. Management interface shall require all users to login with a User Name and Password, and shall support creation of at least 100 unique user accounts.

4. Management interface shall support at least three permission levels for users: read-only, read & change settings, and full administrative system access.

5. Management interface shall be capable of restricting access for user accounts to specific devices within the system.

6. All system devices shall be capable of being given user-defined names.

7. The following device identification information shall be displayed in the Management interface: model number, model description, serial number or network ID, manufacturing date code, custom label(s), and parent network device.

8. Management interface shall be able to read the live status of a networked luminaire or intelligent control device and shall be capable of displaying luminaire on/off status, dim level, power measurement, device temperature, PIR occupancy sensor status, microphonic occupancy sensor status, remaining occupancy time delay, photocell reading, and active Profiles.
9. Management interface shall be able to read the current active settings of a networked luminaire or intelligent control device and shall be capable of displaying dimming trim levels, occupancy sensor and photocell enable/disable, occupancy sensor time delay and light level settings, occupancy sensor response (normal or vacancy), and photocell setpoints and transition time delays.

10. Management interface shall be able to change the current active settings and default settings for an individual networked luminaire or intelligent control device.

11. Management interface shall be capable of applying settings changes for a zone of devices or a group of selected devices using a single “save” action that does not require the user to save settings changes for each individual device.

12. A printable network inventory report shall be available via the management interface.

13. A printable report detailing all system profiles shall be available via the management interface.

14. All sensitive information stored by the software shall be encrypted.

15. All system software updates must be available for automatic download and installation via the internet.

B. Visualization and Programming Interfaces

1. System shall provide an optional web-based visualization interface that displays graphical floorplan.

2. Graphical floorplan shall offer the following types of system visualization:
   a. Full Device Option - A master graphic of the entire building, by floor, showing each control device installed in the project with zones outlined. This shall include, but not be limited to, the following:
      1) Controls embedded light fixtures
      2) Controls devices not embedded in light fixtures
      3) Daylight Sensors
      4) Occupancy Sensors
      5) Wall Switches and Dimmers
      6) Scene Controllers
      7) Networked Relays
      8) Wired Bridges
      9) System Controllers
     10) Wired Relay Panels
     11) Group outlines
   b. Group Only Option - A master graphic of the entire building, by floor, showing only control groups outlined.
   c. Allow for pan and zoom commands so smaller areas can be displayed on a larger scale simply by panning and zooming each floor’s master graphic.
   d. A mouse click on any control device shall display the following information (as applicable):
1) The device catalog number.
2) The device name and custom label.
3) Device diagnostic information.
4) Information about the device status or current configuration is available with an additional mouse click.

C. Personal Control Applications for Wired Devices
1. Software interface shall support personal control software applications that provide user-specific control of individual luminaires/control devices, control zones, global scene presets, and scene selector virtual button presses.
2. The system administrator shall be capable of defining personal control permissions for each user account.
3. Software interface shall provide a Microsoft Windows® operating system taskbar application for personal lighting control.
4. Software interface shall provide an Apple iOS ® operating system application (supported by mobile phones and mobile tablet devices) for personal lighting control.

2.5 SYSTEM BACKBONE AND SYSTEM INTEGRATION EQUIPMENT

A. System Controller
1. Product Series: nECY
2. System Controller shall be multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.
3. System Controller shall have 32-bit microprocessor operating at a minimum of 1 GHz.
4. System Controller shall have minimum of 512MB memory, with a minimum of 4GB non-volatile flash, to support its own operating system and databases.
5. System Controller shall perform the following functions:
   a. Time-based control of downstream wired and wireless network devices.
   b. Linking into an Ethernet network.
   c. Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.
   d. Connection to various software interfaces, including management interface, historical database and analytics interface, and visualization interface.
6. System Controller shall have an integral web server to support configuration, diagnostics and hosting of software interfaces.
7. Device shall have option for a graphical touch screen to support configuration and diagnostics.
8. Device shall have three RJ-45 networked lighting control ports for connection to any of the following:
   a. The graphical touch screen
b. Wired communication bridges
c. Direct connection to networked wired luminaires and intelligent lighting control devices (up to 128 total devices per port)

9. Device shall automatically detect all networked devices connected to it.
10. Device shall have an internal time clock used for astronomical and standard schedules.
11. Device shall have 2 switched RJ-45 10/100 BaseT Ethernet ports for local area network (LAN) connection.
   a. Ethernet connection shall support daisy chain wiring to other lighting control system LAN devices.
   b. Ethernet connection shall support IPv4 and shall be capable of using a dedicated static or DHCP assigned IP address.

12. Device shall have 2 x USB 2.0 Expansion ports for 802.11 Wi-Fi Adapter enabling wireless connectivity including:
   a. Hot Spot
   b. Access Point
   c. Client

13. Each System Controller shall be capable of managing and operating at least 750 networked devices (wired or wireless).
   a. Multiple System Controllers may be networked together via LAN connection to scale the system up to 20,000 networked devices.

14. System Controller shall support BACnet/IP and BACnet MS/TP protocols to directly interface with BMS and HVAC equipment without the need for additional protocol translation gateways.
   a. BACnet MS/TP shall support 9600 to 115200 baud rate.
   b. System Controller shall be BACnet Testing Laboratory (BTL listed) using Device Profile BACnet Building Controller (B-BC) with outlined enhanced features.

15. System controller shall contain a “FIPS 140-2 Level 1 Inside” cryptographic module.
16. System controller shall be available within a NEMA 1 enclosure with Class 1 and Class 2 separation.
   a. Enclosure shall support power input power of 120-277VAC.

2.6 WIRED NETWORKED DEVICES

A. Wired Networked Wall Switches, Dimmers, Scene Controllers
   1. Product Series: nPODM, nPODM xS, nPODM xL
   2. Devices shall recess into single-gang switch box and fit a standard GFI opening.
   3. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
   4. All switches shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.

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5. Devices with mechanical push-buttons shall provide tactile and LED user feedback.

6. Devices with mechanical push-buttons shall be made available with custom button labeling.

7. Wall switches & dimmers shall support the following device options:
   a. Number of control zones: 1, 2 or 4
   b. Control Types Supported:
      1) On/Off
      2) On/Off/Dimming
      3) On/Off/Dimming/Correlated Color Temperature Control for specific luminaire types
   c. Colors: Ivory, White, Light Almond, Gray, Black, Red

8. Scene controllers shall support the following device options:
   a. Number of scenes: 1, 2 or 4
   b. Control Types Supported:
      1) On/Off
      2) On/Off/Dimming
      3) Preset Level Scene Type
      4) On/Off/Dimming/Preset Level for Correlated Color Temperature
      5) Reprogramming of other devices within daisy-chained zone so as to implement user selected lighting scene. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.
      6) Selecting a lighting profile to be run by the system’s upstream controller so as to implement a selected lighting profile across multiple zones. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.
   c. Colors: Ivory, White, Light Almond, Gray, Black, Red

B. Wired Networked Graphic Wall Stations

1. Product Series: nPOD-GFX
2. Device shall surface mount to single-gang switch box.
3. Device shall have a 3.5” full color touch screen.
4. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply.
5. Device shall have a micro-USB style connector for local computer connectivity.
6. Communication shall be over standard low voltage network cabling with RJ-45 connectors.
7. Device shall enable user supplied screen saver image to be uploaded within one of the following formats: jpg, png, gif, bmp, tif.
8. Device shall enable configuration of all switches, dimmers, and lighting preset scenes via password protected setup screens.

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9. Graphic wall stations shall support the following device options:
   a. Number of control zones: Up to 16
   b. Number of scenes: Up to 16
   c. Profile type scene duration: User configurable from 5 minutes to 12 hours
   d. Colors: Ivory, White, Light Almond, Gray, Black

C. Wired Networked Auxiliary Input / Output (I/O) Devices
   1. Product Series: nIO-1S, nIO-RLX, nIO-MLO-5STP, nIO-MLO-AB, nIO-NLI, nIO-X, nIO-D, nIO-EZ-PH, nIO-EZD
   2. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½” knockout.
   3. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
   4. Auxiliary Input/Output Devices shall be specified as an input or output device with the following options:
      a. Contact closure or Pull High input
         1) Input shall be programmable to support maintained or momentary inputs that can activate local or global scenes and profiles, activate lights at a preconfigured level, ramp light level up or down, or toggle lights on/off.
      b. 0-10V analog input
         1) Input shall be programmable to function as a daylight sensor.
      c. RS-232/RS-485 digital input
         1) Input supports activation of up to 4 local or global scenes and profiles, and on/off/dimming control of up to 16 local control zones.
      d. 0-10V dimming control output, capable of sinking up to 20mA of current
         1) Output shall be programmable to support all standard sequence of operations supported by system.
      e. Digital control output via EldoLED LEDcode communication
         1) Output shall be programmable to support light intensity control, as well as optional correlated color temperature (CCT) control, of the connected luminaire.

D. Wired Networked Occupancy and Photosensors
   1. Product Series: nCM, nCMB, nRM, nWV, nHW
   2. Occupancy sensors shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
   3. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.
4. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional “dual” technology shall be used.

5. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.

6. All sensing technologies shall be acoustically passive, meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.

7. System shall have ceiling, fixture, recessed & corner mounted sensors available, with multiple lens options available customized for specific applications.

8. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.

9. All sensors shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.

10. Sensor programming parameter shall be available and configurable remotely from the software and locally via the device push-button.

11. Ceiling mount occupancy sensors shall be available with zero or one integrated dry contact switching relays, capable of switching 1 amp at 24 VAC/VDC (resistive only).

12. Sensors shall be available with one or two occupancy “poles”, each of which provides a programmable time delay.

13. Sensors shall have optional features for photosensor/daylight override, automatic dimming control, and low temperature/high humidity operation.

14. Photosensor shall provide for an on/off set-point, and a dead band to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.

15. Photosensor and dimming sensor’s set-point and dead band shall be automatically calibrated through the sensor’s microprocessor by initiating an “Automatic Set-point Programming” procedure. Min and max dim settings as well as set-point may be manually entered.

16. Dead band setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
17. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The secondary daylight zone shall be capable of being controlled as an “offset” from the primary zone.

E. Wired Networked Wall Switch Sensors
1. Product Series: nWSX LV
2. Devices shall recess into single-gang switch box and fit a standard GFI opening.
3. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
4. All wall switch sensors shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
5. Devices with mechanical push-buttons shall provide tactile user feedback.
6. Wall switches sensors shall support the following device options:
   a. User Input Control Types Supported: On/Off or On/Off/Dimming
   b. Occupancy Sensing Technology: PIR only or Dual Tech acoustic
   c. Daylight Sensing Option: Inhibit Photosensor
   d. Colors: Ivory, White, Light Almond, Gray, Black, Red

F. Wired Networked Power Packs and Secondary Packs
1. Product Series: nPP16, nPP16-ER, nPP20-PL, nSP16, nSP5-PCD, nSP5-2P-LVR, nSHADE, nAR40, nEPS-60, nPS-80
2. Power Packs shall incorporate one optional Class 1 relay, optional 0-10 VDC dimming output, and contribute low voltage Class 2 power to the rest of the system.
3. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC) and carry a plenum rating.
4. Secondary Packs shall incorporate the relay and 0-10 VDC or line voltage dimming output, but shall not be required to contribute system power.
5. Power Supplies shall provide system power only, but are not required to switch line voltage circuit.
6. Auxiliary Relay Packs shall switch low voltage circuits only, capable of switching 1 amp at 40 VAC/VDC (resistive only).
7. Communication shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors. Secondary packs shall receive low voltage power via standard low voltage network cable.
8. Power Pack programming parameters shall be available and configurable remotely from the software and locally via the device push-button.
9. Power Pack shall securely mount through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast/driver channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
10. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.

11. Power/Secondary Packs shall be available with the following options:
   a. Power Pack capable of full 16-Amp switching of all normal power lighting load types, with optional 0-10V dimming output capable of up to 100mA of sink current.
   b. Secondary Pack with UL924 listing for switching of full 16-Amp Emergency Power circuits, with optional 0-10V dimming output capable of up to 100mA of sink current.
   c. Power and Secondary Packs capable of full 20-Amp switching of general purpose receptacle (plug-load) control.
   d. Secondary Pack capable of full 16-Amp switching of all normal power lighting load types.
   e. Secondary Pack capable of 5-Amps switching and dimming 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).
   f. Secondary Pack capable of 5-Amps switching and dimming of 120/277 VAC magnetic low voltage transformers.
   g. Secondary Pack capable of 4-Amps switching and dimming of 120 VAC electronic low voltage transformers.
   h. Secondary Pack capable of louver/damper motor control for skylights.
   i. Secondary Pack capable of providing a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.
   j. Secondary Pack capable of switching 1 amp at 40 VAC/VDC (resistive only) with the intent to provide relay signal to auxiliary system (e.g. BMS).
   k. Power Supply capable of providing auxiliary bus power (no switched or dimmed load).

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

   A. Installation Procedures and Verification
      1. The successful bidder shall review all required installation and pre-startup procedures with the manufacturer’s representative through pre-construction meetings.
      2. The successful bidder shall install and connect the networked lighting control system components according to the manufacturer’s installation instructions, wiring diagrams, the project submittals and plans specifications.

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3. The successful bidder shall be responsible for testing of all low voltage network cable included in the bid. Bidder is responsible for verification of the following minimum parameters:
   a. Wire Map (continuity, pin termination, shorts and open connections, etc.)
   b. Length
   c. Insertion Loss

B. Coordination with Owner’s IT Network Infrastructure
   1. The successful bidder is required to coordinate with the owner’s representative to secure all required network connections to the owner’s IT network infrastructure.
      a. The bidder shall provide to the owner’s representative all network infrastructure requirements of the networked lighting control system.
      b. The bidder shall provide to the manufacturer’s representative all necessary contacts pertaining to the owner’s IT infrastructure, to ensure that the system is properly connected and started up.

C. Documentation and Deliverables
   1. The installing contractor shall be responsible for documenting installed location of all networked devices, including networked luminaires. This includes responsibility to provide as-built plan drawing showing device address barcodes corresponding to locations of installed equipment.
   2. The installing contractor is also responsible for the following additional documentation to the manufacturer’s representative if visualization / graphical floorplan software is provided as part of bid package:
      a. As-Built floor plan drawings showing device address locations required above. All documentation shall remain legible when reproducing\scanning drawing files for electronic submission.
      b. As-Built electrical lighting drawings (reflected ceiling plan) in PDF and CAD format. Architectural floor plans shall be based on as-built conditions.
         1) CAD files shall have layers already turned on/off as desired to be shown in the graphical floorplan background images. The following CAD elements are recommended to be hidden to produce an ideal background graphical image:
            Titleblock
            Text- Inclusive of room names and numbers, fixture tags and drawings notes
            Fixture wiring and homeruns
            Control devices
            Hatching or poché of light fixtures or architectural elements
         2) CAD files shall be of AutoCAD 2013 or earlier. Revit file overall floor plan views shall be exported to AutoCAD 2013.
3.2 SYSTEM STARTUP

A. Upon completion of installation by the installer, including completion of all required verification and documentation required by the manufacturer, the system shall be started up and programmed.
   1. For CAT5 wired devices, low voltage network cable testing shall be performed prior to system startup.

B. System start-up and programming shall include:
   1. Verifying operational communication to all system devices.
   2. Programming the network devices into functional control zones to meet the required sequence of operation.
   3. Programming and verifying all sequence of operations.

C. Initial start-up and programming is to occur on-site.

3.3 PROJECT TURNOVER

A. System Documentation
   1. Submit software database file with desired device labels and notes completed. Changes to this file will not be made by the factory.
   2. Installing contractor to grant access to the owner for the programming database, if requested.

B. Owner Training
   1. Provisions for onsite training for owner and designated attendees to be included in submittal package.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. Work covered by this Section includes furnishing of and paying for all materials, labor, services, equipment, licenses, taxes, other items, and appliances necessary for the execution, installation and completion of all work specified herein and/or shown on the drawings.

B. Pull and junction boxes of appropriate size and depth as indicated on the drawings and as specified hereinafter.

1.2 SUBMITTALS

A. Submittals for products furnished under this section are not required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. For interior work, provide galvanized sheet metal boxes of code thickness with lapped and welded joints, ¾-inch flanges, screw covers, etc.

B. Boxes with concentric knockouts are not acceptable.

C. Provide ground terminal strip and ground pull box and circuits.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide junction boxes where required, sized according to number of conductors in box or type of service to be provided. Minimum junction box size 4 inches square and 2½ inches deep. Provide screw covers for junction boxes.

B. Use minimum 16-gauge steel for pull boxes and provide with screw cover.

C. Install boxes in conduit runs wherever necessary to avoid too long runs or too many bends. Do not exceed 100-foot runs without pull boxes.
D. Rigidly secure boxes to walls or ceilings. Conduit runs will not be considered adequate support.

E. Install boxes with covers in accessible locations.

F. Observe maximum conductor fill as required by the National Electrical Code.

END OF SECTION 26 13 10
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes load centers and panel boards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:
   1. Lighting and appliance branch-circuit panel boards.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.
B. GFCI: Ground-fault circuit interrupter (GFI).
C. RFI: Radio-frequency interference.
D. RMS: Root mean square.
E. SPDT: Single pole, double throw.
F. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

A. Product Data: For each type of panel board, overcurrent protective device, TVSS 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. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
      a. Enclosure types and details for types other than NEMA 250, Type 1.
      b. Bus configuration, current, and voltage ratings.
c. Short-circuit current rating of panelboards and overcurrent protective devices.
d. UL listing for series rating of installed devices.
e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

C. Panel board Schedules: For installation in panel boards. Submit final versions after load balancing.

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.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of panel boards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.7 EXTRA MATERIALS

A. Keys: Four (4) spares of each type of panel board cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, the following:
1. Panel boards, Overcurrent Protective Devices, and Accessories:
   a. Siemens
   b. Square D Co.
   c. Eaton
   d. General Electric
2.2  FABRICATION AND FEATURES

A. Enclosures: Flush- and surface-mounted cabinets as indicated on drawings. NEMA PB 1, Type 1, to meet environmental conditions at installed location.

B. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

C. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

D. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.

E. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.

F. Bus: Hard-drawn copper, 98 percent conductivity. Aluminum is NOT acceptable.

G. Main and Neutral Lugs:
   1. Compression type suitable for use with conductor material on MLO panels.
   2. Mechanical type suitable for use with conductor material on MCB panels.

H. Equipment Ground Bus: Copper, Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

I. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

J. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box, where indicated on drawings.

K. Gutter Barrier: Arrange to isolate individual panel sections.

2.3  PANEL BOARD SHORT-CIRCUIT RATING

A. UL label indicating series-connected rating with integral or remote upstream devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.

B. Fully rated to interrupt symmetrical short-circuit current available at terminals.

C. See panel schedules for minimum rating.

2.5  LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANEL BOARDS
A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.6 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents. Breakers shall be fully rated for panel AIC rating.
   2. GFCI Circuit Breakers: Single- and two-pole configurations with 30-mA trip sensitivity.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panel boards and accessories according to NEMA PB 1.1 and the NEC.

B. Provide minimum 3-foot clearance in front of panel board.

C. Space panels 4 inches apart.

D. Locate Surge suppression above and adjacent to panelboard serving. Provide additional spacing between panelboards. Surge suppression to be no greater than 7 feet above finished floor.

E. Locate contactors adjacent to panelboards and provide additional spacing. Small contactor enclosures can be above and to the right or left of the panelboard. Contactor mounting height to be no greater than 7 feet above finished floor.

F. Coordinate with other equipment in the room.

G. Coordinate location of panelboards with transformers and conduit feeders.

H. Mounting Heights: Top of trim 74 inches above finished floor, unless otherwise indicated. Mount with at least 6 inches of clearance below panel board.

I. Mounting: Plumb and rigid without distortion of box. Mount recessed panel boards with fronts uniformly flush with wall finish.
J. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panel board loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable. Use manufacturers supplied card and permanent slot location.

K. Install filler plates in unused spaces.

L. Provision for Future Circuits at Flush Panel boards: Stub four 1-inch empty conduits from panel board into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

M. Provision for Future Circuits at Recessed panel boards: Stub four ¾” inch empty conduits from panel board into accessible ceiling space or space designated to be ceiling space in the future. Stub four ¾” inch empty conduits into raised floor space or below slab not on grade.

N. Wiring in Panel board Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section “Electrical Identification.”

B. Label and identify all breakers with permanent engraved labels for panel subfeeders and equipment connections on all distribution panelboards.

C. Panel board Nameplates: Label all panel boards with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws. Provide red nameplates for emergency or stand-by power branch fed panels. Nameplate shall include:
   1. Normal Power
      a. Panel Name
      b. Voltage “277/480”, “120/208”, or “120/240”
      c. Panel fed from “panel name or transformer name”
   2. Generator Powered Panels
      a. Panel Name
      b. Voltage “277/480”, “120/208”, or “120/240”
      c. Panel fed from “panel name or transformer name”
      d. Non-Hospital
         1) Non-emergency, “Stand-By Branch”
         2) Life Safety Non-Hospital, “Life Safety Branch”
3.3 CONNECTIONS
A. Install equipment grounding connections for panel boards with ground continuity to main electrical ground bus.
B. 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 and UL 486B.

3.4 FIELD QUALITY CONTROL
A. Prepare for acceptance tests as follows:
   1. Test insulation resistance for each panel board bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.
B. Testing: After installing panel boards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
   1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. 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. Balance Loads: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:
   1. Measure as directed during period of normal system loading.
   2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data-processing, computing, transmitting, and receiving equipment.
   3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
   4. Tolerance: Difference exceeding 20 percent between phase loads, within a panel board, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.5 ADJUSTING
A. Provide factory technician to set field-adjustable switches and circuit-breaker trip ranges.

3.6 CLEANING
A. On completion of installation, inspect interior and exterior of panel boards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes receptacles, connectors, switches, and finish plates.

1.3 DEFINITIONS

A. GFCI/GFI: Ground-fault circuit interrupter.

B. SPD: Surge protective device.

1.4 SUBMITTALS

A. Product Data: For each product specified.

B. Shop Drawings: Legends for receptacles and switch plates.

C. Samples: For devices and device plates for color selection and evaluation of technical features.

D. Maintenance Data: For materials and products to include in maintenance manuals specified in Division 1.

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.

B. Comply with NEMA WD 1.

C. Comply with NFPA 70.
1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

PART 1 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Wiring Devices:
      a. Bryant Electric, Inc.
      b. Eaton.
      d. Killark Electric Manufacturing Co.
      e. Leviton Manufacturing Co., Inc.
      f. Pass & Seymour/Legrand; Wiring Devices Div.
   2. Floor Service Outlets and Telephone/Power Poles:
      c. Pass & Seymour/Legrand; Wiring Devices Div.
      d. Square D Co.
      e. Wiremold.

2.2 RECEPTACLES

A. Straight-Blade and Locking Receptacles: Commercial spec grade Configuration NEMA 5-20R. Color by Architect/Owner.

B. GFCI Receptacles: Feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle arranged to protect connected downstream receptacles on same circuit. Design units for installation in a 2¾-inch-deep outlet box without an adapter. Provide with test light as per NEC.

D. Fifteen amp (15A) receptacles are not acceptable and shall not be installed unless specifically directed by the engineer.

2.5 SWITCHES

A. Snap Switches: Commercial spec grade.

2.6 WALL PLATES
A. Single and combination types match corresponding wiring devices. CSA certified and UL listed.
   2. Material for Finished Spaces:
      a. Smooth, high impact self-extinguishing nylon, reinforcement ribs, captive screws; color by Architect/Owner.

2.7 FLOOR POKE THRU

A. Type: Fire rated poke thru device with power/data. Refer to drawings for specific device.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies straight, plumb and secure. Do not overtighten to deform faceplate. Adjust receptacle depth so faceplate mounts flush with wall. Adjust receptacle to extend equilaterally 1/8” beyond the faceplate opening.

B. Install devices as per ADA height requirements.

C. Review Architectural elevations to coordinate locations and mounting heights. If there are any discrepancies request information prior to install. If height is not listed on the drawings refer to the following:
   1. General purpose receptacles @ 18” AFF to the center of the duplex or simplex.
   2. General purpose receptacles at retirement facilities, nursing homes, hospice, nursing facilities @ 24” AFF.
   3. TV receptacles at the TV mounting location (see architectural elevations) or at 96” AFF.
   4. Above counter receptacles @ 6” above backsplash.
   5. Toilet room receptacles @ 48” AFF to the top of the box
   6. Switches to be 48” AFF to the centerline of the switch.
   7. Equipment receptacles at the piece of equipment. Coordinate with architectural elevations and equipment submittals.
   8. Refrigerator receptacles mount at 36” AFF to the center of the receptacle.
   9. Receptacles shall not be installed flat on any counter surface.
 10. No general purpose receptacles shall be below 15” in height or above 48” AFF.

D. Install wall plates when painting is complete. Remove all paint from any wall plates.

E. Provide GFI receptacles within 6 feet of all sinks, exterior receptacles, undercounter equipment, at exterior HVAC equipment, vending machines, and in kitchens.
F. Install wall dimmers to achieve indicated rating after de-rating for ganging as instructed by manufacturer.

G. Do not share neutral conductor on load side of dimmers.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on bottom. Group adjacent switches under single, multi-gang wall plates.

I. Protect devices and assemblies during painting.

J. Mount receptacles in millwork flush with the millwork. Provide extension rings.

K. Adjust locations at which floor service outlets and telephone/power service poles are installed to suit arrangement of partitions and furnishings.

L. GFCI or GFI receptacles shall be wired to “trip” individually not the entire circuit. Receptacles shall not be daisy chained together from a GFI and create a GFI “protected” receptacle.

3.2 IDENTIFICATION

A. Comply with Section “Electrical Identification.”
   1. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.
   2. Receptacles: Identify panelboard and circuit number from which served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of plate and durable wire markers or tags within outlet boxes.

3.3 CONNECTIONS

A. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.

B. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.

B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
C. Replace damaged or defective components.

3.5 CLEANING

A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.
SECTION 26 28 16

DISCONNECT 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes individually mounted switches and circuit breakers used for the following:
   1. Equipment disconnect switches.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Section “Wiring Devices” for attachment plugs and receptacles, and snap switches used for disconnect switches.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for disconnect switches, and accessories specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain disconnect switches from one source and by a single manufacturer.

B. Comply with NFPA 70 for components and installation.

C. Listing and Labeling: Provide disconnect switches and circuit breakers specified in this Section that are listed and labeled.
   1. The Terms “Listed” and “Labeled”: As defined in the National Electrical Code, Article 100.

PART 2 - PRODUCTS

DISCONNECT SWITCHES AND CIRCUIT BREAKERS – 26 28 16.1

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2.1 DISCONNECT SWITCHES

A. Enclosed, 600V Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle. Switch shall be rated for equipment amperage.

B. Enclosure: NEMA KS 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location.

C. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.

D. Accessories: As indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install disconnect switches in locations as indicated, according to manufacturer’s written instructions.

B. Install disconnect switches and circuit breakers level and plumb. Height of handle centerline shall not exceed 68 inches. Provide required clearance in front of disconnect switches voltage requirements by NEC.

C. Grounding: Ground case and metallic conduit of disconnects.

D. Provide working clearance in front of disconnect switch per NEC, minimum 36 inches.

E. Connect disconnect switches and circuit breakers and components to wiring system and to ground as indicated and instructed by manufacturer.
   1. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. Where manufacturer’s torque values are not indicated, use those specified in UL 486 A and UL 486 B.

F. Label and identify each disconnect switch and enclosed circuit breaker according to requirements specified in Section “Electrical Identification.” Labels shall be 1” for 100A and smaller, 2” for 200 – 400A switches, and 3 inch for larger switches.

3.2 FIELD QUALITY CONTROL

A. Testing: After installing disconnect switches and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

B. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.
3.3 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

END OF SECTION
SECTION 26 51 00
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes interior lighting fixtures, lamps, ballasts, emergency lighting units, and accessories.

1.3 SUBMITTALS

A. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:
   1. Dimensions of fixtures.
   2. Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric data.
   3. Certified results of laboratory tests for fixtures and lamps for photometric performance.
   4. Fluorescent and high-intensity-discharge ballasts.
   5. Types of lamps.

B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, method of field assembly, components, features, and accessories.
   1. Wiring Diagrams: Detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

D. Maintenance Data: For lighting fixtures to include in maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE
A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

B. Comply with NFPA 70.

C. FM Compliance: Fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM.

D. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.5 COORDINATION

A. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

1.6 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1. Warranties for LED Drivers; Written warranty, executed by manufacturer agreeing to replace LED drivers that fail in materials or workmanship within five years from date of manufacture, but not less than four years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers and Models: As indicated on the drawings and lighting fixture schedule. Additional manufacturers may be considered as equal after review from the design engineer. Submit two copies to the design engineer for review prior to bid. Include a cross reference for each fixture submitted. Equipment submitted for “as-equal” without complete cutsheet cross reference, to include drawing fixture lettering, is subject to immediate rejection.

1. Additional manufacturers will be considered on a case by case basis prior to bid. Post-bid non-approved manufacturers/models are subject to rejection and any cost difference for approved fixtures will be the contractors’ responsibility.

2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs, sharp corners, and edges.
B. Sheet Metal Components:
   1. Steel, unless otherwise indicated.
   2. Form and support to prevent warping and sagging.
   3. Housing painted after fabrication.
   4. Smooth hemmed sides and smooth inward formed end flanges.

C. Doors, Frames, and Other Internal Access:
   1. Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.
   2. Standard extruded aluminum door frame has superior structural integrity with premium appearance and mitered corners. Door frame is painted after fabrication, standard. Powder-painted rotary cam latches provide easy, secure door closure. Integral T-bar clips are standard. Acrylic shielding materials is 100% UV stabilized.

D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.
   4. Laminated Silver Metallized Film: 90 percent.

E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.
   1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
   2. Lens Thickness: 0.125-inch minimum, unless greater thickness is indicated.

F. Housings: Manufacturers standard with integral heat sink.

G. Fixture Type Components:
   2. Downlight:
      a. Universal mounting bracket.
      b. Integral junction box with conduit fittings.
      c. Battery backup test button and integral to fixture.
   3. Recessed Linear: Integral junction box with conduit fittings.
   4. Surface Mount, Linear
      a. Universal mounting bracket.
      b. Integral junction box with conduit fittings.
   5. Surface Mount, Nonlinear
      a. Universal mounting bracket.
      b. Integral junction box with conduit fittings.
   6. Suspended, Linear
      a. Pendant mounted with secondary support provision.
b. Universal mounting bracket.
c. Provide with aircraft cable.
d. Fixtures shall join with factory fittings of length on drawings with factory ends.
e. Coordinate cord drop.
f. Power feed thru factory quick connect.
g. White cord drop to end of fixture.
h. Minimum two supports per run. Minimum one every 8 feet.

7. Suspended, Nonlinear
   a. Pendant mounted with secondary support provision.
   b. Universal mounting bracket.

2.5 LED LIGHTING

A. General: Comply with fixture component requirements.

B. All LED products must be UL, ETL and/or CSA listed.

C. All LED products must have LM-79 and LM-80 testing minimum and noted on specification sheet by an independent test lab and in accordance with the following:
   1. Lay-in Troffers:  L90 at 60,000 hours at 25 degrees C.
   2. Surface Mounted:  L80 at 60,000 hours at 25 degrees C.
   3. Pendant Mount:  L90 at 60,000 hours at 25 degrees C.
   4. Recessed Can:  L70 at 50,000 hours at 25 degrees C.
   5. High Bay:  L70 at 90,000 hours at 25 degrees C. or
   6. L95 at 60,000 hours at 25 degrees C. *
   7. Exterior Surf Mtd:  L90 at 100,000 hours at 40 degrees C or
                      L80 at 100,000 hours at 25 degrees C *
   8. High Bay and Exterior Fixtures shall be Thermally Protected Drivers

D. All LED products should be identified as L70 and/or L90 ratings based on independent test lab data.

E. Long-life LEDs, coupled with high-efficiency drivers, provide superior level and quality of illumination for extended service life.

F. All LED products must be serviceable for accessible for field repair needs. Drivers and internal components are accessible from floor. LED boards include plug-in connectors for easy replacement or servicing. Suitable for direct insulation contact. Suitable for damp location.

G. Standard embedded controls continuously monitor system performance, allow for constant lumen management/compensation function, facilitate simple “plug-and-play” network and controls upgrading via Cat-5 cable.

H. Minimum CRI 80.
I. All indoor lighting color rendering should be within a 3 step McAdams ellipse. All indoor lighting should be 4000 kelvin unless specifically noted.

J. All LED drivers should be capable of 0-10 volt controls and DMX control and shall dim to 1% of total lumen output. Where specifically specified the dimming driver may be required to dim to .1% of lumen output, otherwise known as “dim to dark”.

K. Driver manufacturers must have a 5 year history producing dimmable electronic LED drivers for the North American market.

L. Ambient driver temperatures must be within -20 degrees to 50 degrees C (-4 degrees to 122 degrees F).

M. Driver must limit inrush current.
   1. Base specification: meet or exceed NEMA 410 driver inrush standard of 430 amp per 10 amps load with a maximum of 370 amps/2 seconds
   2. Preferred specification: Meet or exceed 30ma’s at 277 VAC for up to 50 watts of load and 75A at 240us at 277 VAC for 100 watts of load
   3. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A
   4. No visible change in light output with a variation of plus/minus 10 percent line voltage input.
   5. Total harmonic distortion less than 20%, and meet ANSI C82.11 maximum allowable THD requirements at full output. THD shall at no point in the dimming curve allow imbalance current to exceed full output THD

N. Any exceptions are at the engineers discretion based on project needs and applicability.

2.6 EXIT SIGNS

A. General Requirements: Comply with UL 924 and the following:
   1. Sign Colors and Lettering Size: Comply with authorities having jurisdiction.
   2. Die cast brushed metal finish exit signage with manufacturer’s multi-style mounting (wall, surface, and top). Plastic exit signage is not acceptable.

B. Internally Lighted Signs: As follows:
   1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.
   2. All exit signs shall have battery back-up.
   3. Provide with self-diagnostics as indicated on the drawings.

2.7 FIXTURE SUPPORT COMPONENTS

A. Comply with Section “Basic Electrical Materials and Methods,” for channel- and angle-iron supports and nonmetallic channel and angle supports.
B. Single-Stem Hangers: ½-inch steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.
C. Twin-Stem Hangers: Two, ½-inch steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.

D. Rod Hangers: 3/16-inch- 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.

F. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

2.8 FINISHES

A. Fixtures: See fixture schedule for colors and finishes. Otherwise manufacturer's standard.
   1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixtures, General: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture.
   1. Coordinate location of fixtures with architectural ceiling plan.
   2. Review architectural elevations prior to rough-in for any wall mounted fixtures. Mount at 84 inches or above, unless otherwise indicated. All wall mounted fixtures shall be ADA compatible if below 84 inches.
   3. Center single fixtures in rooms as much as possible.
   4. Center fixtures in exposed ceilings. Provide equal distance between fixtures and structural elements (walls, columns, furrdowns, etc.).
   5. Provide switching mechanisms for all fixtures whether indicated on the drawings or not.
   6. Provide supports without causing deflection of ceiling or wall.
   7. Secure to outlet box.

B. Track Lighting
   1. Install track parallel with structural or grid. Secure track to structural mounted j-boxes.
   2. Conceal transformers above accessible ceiling.
   3. Coordinate with architect for track lighting head locations.
4. Aim track heads at objects to be illuminated
5. Adjust pendant track fixtures per architect/owner.

C. Remote Battery:
1. Mount battery backup over accessible ceiling spaces. Provide appropriate battery backup for mounting distance away from fixture.
2. Mount all remote battery packs together as much as possible over accessible ceiling spaces and mount on unistrut with backboard. **Do not mount directly to wall.** Bundle cabling together and label battery packs corresponding to fixture. Provide diagram as required.

D. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for alignment.
1. Install a minimum of four (4) ceiling support system rods or wires attached to the fixture structure on EACH fixture secured to the building structure. Locate not more than 6 inches from fixture corners.
2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner.
3. Fixtures of Sizes Less Than Ceiling Grid: Arrange as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two (2) ¾-inch metal channels spanning and secured to ceiling tees.

E. Suspended Fixture Support: As follows:
1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging. Provide blocking for heavy fixtures.
2. Stem- Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Coordinate mounting heights with Architect/Engineer. Consult prior to hanging. Stems may need to be field cut.
5. Chain hung fixtures are NOT acceptable unless indicated on the drawings.
6. Provide secondary support for all fixtures without canopy support from structure.
   a. All high and low bay fixtures shall have secondary support cables secured to structure.
7. Sized and rated for fixture weight.
8. Do not use ceiling grid as support for pendant luminaires. Connect support wired or rods to building structure.

F. Flush-Mounted Luminaire Support:
1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

G. Wall-Mounted Luminaire Support:
   1. Attached to structural members in walls.
   2. Do not attach luminaires directly to gypsum board.
   3. Provide blocking to support.

3.2 CONNECTIONS

A. Ground equipment:
   1. Tighten electrical connectors and terminals according to manufacturers’
      published torque-tightening values. If manufacturer's torque values are not
      indicated, use those specified in UL 486A and UL 486B.

B. Connect to switch mechanisms (wall switch, contactors, relays) room controllers.

C. Provide dual switching for room mounted dual ballast fixtures. Wire each switch leg
   to each ballast. Do not connect together unless directed by engineer.
   1. Exception: Step dimming fixtures in corridors may be connected together.
      Consult engineer prior to connections and installing switch legs.

D. Fixture Connections:
   1. Indoors
      a. With Lay-in ceilings: Provide EMT home runs to structure mounted J-
         boxes. Provide MC Cable from above ceiling j-boxes to fixtures. Do not
         daisy chain fixtures together unless specifically indicated on the drawings
         or allowed by engineer.
      b. With gypboard ceilings: Provide EMT home runs to structure mounted J-
         boxes. Provide access to j-boxes or locate above fixtures. Provide MC
         Cable from above ceiling j-boxes to fixtures. Do not wire daisy chain
         fixtures together, unless indicated on the drawings.
      c. Exposed (no ceiling) in finished spaces: Conceal EMT as much as
         possible in adjacent walls. Route EMT to fixtures in exposed spaces with
         steel compression fittings and install parallel along structural members to
         structural mounted j-boxes. Conceal conduit along structural members.
         DO NOT route conduit across open spaces suspended from structural
         members unless directed by architect or engineer. Mount fixtures from j-
         boxes. Center fixtures in spaces.
      d. Exposed unfinished spaces: Provide EMT runs to structural mounted J-
         boxes. Route parallel to structural members as much as possible. Mount
         fixtures or fixture support to j-boxes.

3.3 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and
   components.
B. Advance Notice: Give dates and times for field tests.

C. Provide instruments to make and record test results.

D. Tests: As follows:
   1. Verify normal operation of each fixture after installation.
   2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.
   3. Verify normal transfer to battery source and retransfer to normal.
   4. Report results in writing.

E. Malfunctioning Fixtures and Components (Except LED Fixtures): Replace or repair, then retest. Repeat procedure until units operate properly.

F. Malfunctioning LED Fixtures: Replace fixture then retest. LED fixtures shall not be repaired.

G. Corrosive Fixtures: Replace during warranty period.

3.4 CLEANING AND ADJUSTING

A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION
SECTION 27 74 50
TELEPHONE AND DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes installation for wiring systems to be used as signal pathways for voice and high-speed data transmission. The wiring, jacks, plates, and local terminations are included in the project. Termination in the IT/MDF closet will be by others.

1.3 RELATED WORK

A. Section “Basic Electrical Methods and Materials.”
B. Section “Raceways and Boxes.”
C. Section “Wiring Devices.”

1.4 DEFINITIONS

A. EMI: Electromagnetic interference.
B. IDC: Insulation displacement connector.
C. LAN: Local area network.
D. STP: Shielded twisted pair.
E. UTP: Unshielded twisted pair.

1.5 SUBMITTALS

A. Shop Drawings: Include dimensioned plan and elevation views of components. Show access and workspace requirements.
1. System labeling schedules, including electronic copy of labeling schedules, as specified in Part 3, in software and format selected by Owner.

B. Qualification Data: For firms and persons specified in “Quality Assurance” Article. Provide evidence of applicable registration or certification.

1.6 COORDINATION

A. Coordinate Work of this Section with Owner's telephone switch, telephone instrument, workstation, and LAN equipment suppliers.
   1. Meet jointly with representatives of above organizations and Owner's representatives to exchange information and agree on details of equipment arrangements and installation interfaces.

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. General: Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance.

B. Installation shall include backboxes, jacks and coverplates. TAMU standard wiring shall be provided and installed from the device to the appropriate IT/MDF room. Termination and the device shall be completed by the contractor as directed by the owner. Provide adequate slack in the IT/MDF room for termination by the owner.

2.2 MOUNTING ELEMENTS

A. Raceways and Boxes: Boxes to be minimum 2 1/2 inches deep, two gang, with plaster ring. Comply with Section "Raceways and Boxes."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cable. Check raceways, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Conceal raceway and wiring except in unfinished spaces.
B. Install exposed raceway parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.

C. Install raceway with wire elbow sweeps suitable for floor installation.

D. Provide raceway from drop locations to cable tray.

E. See floor plans for mounting heights and raceway sizes.

3.3 GROUNDING

A. Comply with Section “Grounding and Bonding.”

3.4 IDENTIFICATION

A. Identify system components complying with applicable requirements in Section “Electrical Identification” and the following Specifications.

B. System: Owner will provide scheme at coordination meeting.

3.5 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION
SECTION 28 32 00

FIRE ALARM EXPANSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division I Specification Sections, apply to this Section.

1.2 SCOPE

A. Provide new devices and connect to existing fire alarm control panel. All new devices shall be by existing manufacturer and shall fully integrate into the existing system. Recalculate battery power required and EOL resistors. Provide expansion panel if FACP cannot accommodate additional devices. The contractor shall be responsible prior to bid for a price for a complete system to include; manual stations, detectors, signal equipment, controls, expansion panels, and devices. The drawings are schematic in nature and include approximate locations of devices. The fire alarm contractor shall coordinate the exact location of the visual signaling device in accordance with the candela of the installed devices.

B. Daisy chain expansion panels to main FACP.

1.3 SUMMARY

A. This Section includes fire alarm systems with manual stations, detectors, signal equipment, controls, and devices.

1.4 DEFINITIONS

A. FACP: Fire alarm control panel.

B. LED: Light-emitting diode.

C. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.5 SYSTEM DESCRIPTION

A. All new devices shall match those currently in use in the facility and be fully compatible with the existing system. The current sequence of operation shall be maintained for the new devices in the renovated area.
B. A full system test/inspection shall be provided by the fire alarm Contractor for a period of one (1) year as a part of the contract.

C. The system as described shall be modified, programmed, tested and delivered to the Owner complete and in fully operational condition. The system shall include all necessary hardware, software, raceways and interconnecting wiring to accomplish the requirements of this specification and the Contract Drawings.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show details of graphic annunciator.
   1. Wiring Diagrams: Detail wiring and differentiate between manufacturer-installed and field-installed wiring. Include diagrams for equipment and for system with all terminals and interconnections identified.
   2. Battery: Sizing calculations.
   3. Floor Plans: Indicate final outlet locations and routings of raceway connections.
   4. Device Address List: Coordinate with final system programming.
   5. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.

C. Installer Certificates: Signed by manufacturer certifying that installers comply with requirements.

D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Comply with NFPA 72.

E. Maintenance Data: For fire alarm systems to include in maintenance manuals specified in Division 1. Comply with NFPA 72.

F. Submissions to Authorities Having Jurisdiction: In addition to distribution requirements for Submittals specified in Section “Submittals,” make an identical submission to authorities having jurisdiction. Include copies of annotated Contract Drawings as needed to depict component locations to facilitate review. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.

G. Certificate of Completion: Comply with NFPA 72, AHJ, and local amendments.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is an authorized representative of the FACP manufacturer for both installation and maintenance of units required for this Project.
B. Source Limitations: Obtain fire alarm system components through one source and from the manufacturer of the system already in the building.

C. Compliance with Local Requirements: Comply with applicable building code, local ordinances and regulations, and requirements of authorities having jurisdiction.

D. Comply with NFPA 72.

1.8 SEQUENCING AND SCHEDULING

A. Existing Fire Alarm Equipment: Maintain fully operational until new equipment has been tested and accepted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide products to match existing in both form and function.

2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

A. Control of System: By the FACP.

B. System Supervision: Automatically detect and report open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.

C. Priority of Signals: Automatic alarm response functions resulting from an alarm signal from one zone or device are not altered by subsequent alarm, supervisory, or trouble signals. An alarm signal is the highest priority. Supervisory and trouble signals have second- and third-level priority. Higher-priority signals take precedence over signals of lower priority, even when the lower-priority condition occurs first. Annunciate and display all alarm, supervisory, and trouble signals regardless of priority or order received.

D. System Reset: All zones are manually resettable from the FACP after initiating devices are restored to normal.

E. System Alarm Capability during Circuit Fault Conditions: System wiring and circuit

1.3 MANUAL PULL STATIONS

A. Description: Fabricated of metal or plastic, and finished in red with molded, raised-letter operating instructions of contrasting color.
2. Double-action mechanism requires two actions, such as a push and a pull, to initiate an alarm.
3. Station Reset: Key or wrench operated; double pole, double throw; switch rated for the voltage and current at which it operates.
4. 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.
5. Integral Addressable Module: Arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.

1.4 SMOKE DETECTORS

A. General: Include the following features:
   1. Operating Voltage: 24V powered from the fire alarm control panel.
   2. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
   3. Plug-in Arrangement: Detector and associated electronic components are mounted in a module that connects in a tamper-resistant manner to a fixed base with a twist-locking plug connection. Terminals in the fixed base accept building wiring.
   4. Integral Visual-Indicating Light: LED type. Indicates detector has operated.
   5. Sensitivity: Can be tested and adjusted in-place after installation.
   6. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
   7. Remote Controllability: Unless otherwise indicated, detectors are analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.

B. Smoke detectors shall be photoelectric type.
   1. Sensor: LED or infrared light source with matching silicon-cell receiver.
   2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.
   3. Integral Thermal Detector: Fixed-temperature type with 135 deg F setting.

2.5 NOTIFICATION APPLIANCES

A. Description: Equipped for mounting as indicated and have screw terminals for system connections.
   2. Devices shall be red in color.

B. Audio Alarm Devices (Horns – Interior Installation):
1. Electronic-vibrating-polarized type, 24V dc; with provision for housing the operating mechanism behind a grille. Horns produce a minimum sound pressure level of 85 dB, measured 10 feet from the horn.
2. Device to be complete with outlet box, mounting plate, mounting hardware, and terminal strip for wiring connections.

C. Audio Alarm Devices (Horns – Mini Horns):
   1. Electronic-vibrating-polarized type, 24V dc, “mini horn”, with provision for housing the operating mechanism behind a grille. Horns produce a minimum sound pressure level of 85 dB, measured 10 feet from the horn.
   2. Device to be complete with outlet box, mounting plate, mounting hardware, and terminal strip for wiring connections.

D. Audio Alarm Devices (Horns – Exterior Installation):
   1. Electronic--vibrating-polarized type, 24V dc; with provision for housing the operating mechanism behind a grille. Horns produce a minimum sound pressure level of 85 dB, measured 10 feet from the horn.
   2. Grille and device to be of weatherproof design and construction.
   3. Device to be complete with outlet box, mounting plate, mounting hardware, and terminal strip for wiring connections.

E. Visual Alarm Devices (Strobe Lights): Xenon strobe lights listed under UL 1971 with clear or nominal white polycarbonate lens. Mount lens on an aluminum faceplate. The word “FIRE” is engraved shall be engraved on the device.
   1. Rated Light Output: 75 candela (minimum), 110 candela in larger coverage spaces.
   2. Strobe Leads: Factory connected to screw terminals.

F. Audio/Visual Alarm Devices (Horn and Strobe Light): Combination audio and visual alarm devices consisting of the same devices indicated above for “Audio Alarm Devices (Horns)” and “Visual Alarm Devices (Strobe Lights)” provided as a single combination alarm device.

2.6 WIRE

   1. Low-Voltage Circuits: No. 16 AWG, minimum.
   2. Line-Voltage Circuits: No. 12 AWG, minimum.

B. Power-Limited Circuits: NFPA 70, Types FPL, FPLR, or FPLP, as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

B. Ceiling-Mounted Smoke Detectors: Not less than 4 inches from a side wall to the near edge. For exposed solid-joist construction, mount detectors on the bottom of joists. On smooth ceilings, install not more than 30 feet apart in any direction.

C. Wall-Mounted Smoke Detectors: At least 4 inches, but not more than 12 inches, below the ceiling.

D. Smoke Detectors near Air Registers: Install no closer than 60 inches.

E. Audible Alarm-Indicating Devices: Install so the top of the device is no less than 90 inches above finish floor and not less than 6 inches below the ceiling. Do not install higher than 120 inches unless directed. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Combine audible and visible alarms at the same location into a single unit.

F. Visible Alarm-Indicating Devices: Install so the top of the device is no less than 90 inches above finish floor and not less than 6 inches below the ceiling. Do not install higher than 120 inches unless directed.

3.2 WIRING INSTALLATION

A. Wiring Method: Install wiring in metal raceway according to specification section “Raceways and Boxes.” Conceal raceway except in unfinished spaces and as indicated.

B. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by the manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

C. Cable Taps: Use numbered terminal strips in junction, pull and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

D. Color-Coding: Red fire alarm plenum rated conductors. Paint fire alarm system junction boxes and covers red.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals according to specification section “Electrical Identification.”
B. Install instructions frame in a location visible from the Fire Alarm Panel.

C. Paint power-supply disconnect switch red and label “FIRE ALARM.”

3.4 APPLICATION SCHEDULE

A. General Application: Provide fire alarm devices where indicated on drawings or as scheduled below. Locations on drawings are approximate. Contractor shall coordinate exact locations with architectural drawings. Contractor shall submit locations of fire alarm devices to engineer/architect as part of fire alarm shop drawings. Locations shall be based upon ability to mount the device to building construction and coverage afforded the device.

B. Pull Station: Provide pull stations within 5 feet of all exits to building and second floor stairwell access.

C. Audio/Visuals and Visuals: Device locations indicated on the drawings are approximate. Coordinate with architectural for exact locations and install as per coverage criteria. Install devices in areas that are unobtrusive to room or space intent (e.g. do not install device at the back of the stage, but install stage device off to one side; or do not try to install device on glass block wall).

3.5 FIELD QUALITY CONTROL

A. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect field-assembled components and connections and to supervise pretesting, testing, and adjustment of the system. Report results in writing.

B. Pretesting: After installation, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the compliance of the system with requirements of Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones, and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

C. Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of witnesses to preliminary tests.

D. Final Test Notice: Provide a minimum of 10 days' notice in writing when the system is ready for final acceptance testing.

E. Minimum System Tests: Test the system according to procedures outlined in NFPA 72. Minimum required tests are as follows:
   1. Verify the absence of unwanted voltages between circuit conductors and ground.
   2. Test all conductors for short circuits using an insulation-testing device.
3. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on record drawings.

4. Verify that the control unit is in the normal condition as detailed in the manufacturer's operation and maintenance manual.

5. Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of initiating and indicating devices. Observe proper signal transmission according to class of wiring used.

6. Test each initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.

7. Test the system for all specified functions according to the approved operation and maintenance manual. Systematically initiate specified functional performance items at each station, including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications. Observe all voice audio for routing, clarity, quality, freedom from noise and distortion, and proper volume level.

8. Test Both Primary and Secondary Power: Verify by test that the secondary power system is capable of operating the system for the period and in the manner specified.

F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets Specifications and complies with applicable standards.

G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log on the satisfactory completion of tests.

H. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

3.6 CLEANING AND ADJUSTING

A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and marred finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

END OF SECTION