Wayne State University
Prentis Computer Lab Relocation 2018
WSU Project Number 122-313456
Prevailing Wage Work

Note – Electronic Bid Submissions

FOR:
Board of Governors
Wayne State University
Detroit, Michigan

Owner’s Agent:
Robert Kuhn, Sr. Buyer
WSU – Procurement & Strategic Sourcing
5700 Cass, Suite 4200
Detroit, Michigan 48202
313-577-3712 / 313-577-3747 fax
ac6243@wayne.edu and copy leiann.day@wayne.edu

Owner's Representative:
T. Allen Gigliotti, Project Manager
Facilities Planning & Management
Design & Construction Services
5454 Cass
Wayne State University
Detroit, Michigan 48202

Consultant:
Fishbeck, Carr, Thompson & Huber
39500 MacKenzie Drive, Suite 100
Novi, MI 48377

August 14, 2018
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INFORMATION FOR BIDDERS

OWNER: Board of Governors  
Wayne State University

PROJECT: Prentis Computer Lab Relocation 2018  
Project No. 122-313456

LOCATION: Wayne State University  
5201 Cass  
Detroit, Michigan 48202

OWNER’S AGENT: Robert Kuhn, Sr. Buyer  
WSU – Procurement & Strategic Sourcing  
5700 Cass, Suite 4200  
Detroit, Michigan 48202  
313-577-3712 / 313-577-3747 fax  
ac6243@wayne.edu & copy leiann.day@wayne.edu

OWNER’S REPRESENTATIVE: T. Allen Gigliotti, Project Manager  
Facilities Planning & Management  
Design & Construction Services  
Wayne State University  
5454 Cass Avenue  
Detroit, Michigan 48202

Architect: Fishbeck, Carr, Thompson & Huber  
39500 MacKenzie Drive, Suite 100  
Novi, MI 48377

SPECIAL NOTE: Right to reject any and all proposals, either in whole or in part and to waive any irregularities therein is reserved by the Owner.

BIDS ADVERTISED: August 14, 2018

BIDDING: Bidding documents may be obtained by vendors from the University Purchasing Web Site at http://go.wayne.edu/bids beginning August 14, 2018. When visiting the Web Site, click on the "Construction" link in green. Copies of the RFP will not be available at the pre-proposal meeting.

MANDATORY Pre-Bid Conference: 10:00 AM, local time, August 21, 2018 to be held at Wayne State University – 5454 Cass, Conference Room 3, Detroit, MI, 48202. Late Arrivals may not be permitted to submit bids.

OPTIONAL Second Walk Through (if needed): To be determined at the conclusion of the pre-bid conference, by those in attendance.

DUE DATE FOR QUESTIONS: Due Date for questions shall be August 27, 2018 at 12:00 Noon. All questions must be reduced to writing and emailed to the attention of Robert Kuhn, Sr. Buyer at ac6243@wayne.edu, copy to Leiann Day, Associate Director, Procurement at leiann.day@wayne.edu.

Bids Due: Sealed proposals for lump-sum General Contract will be received at the office of the Procurement & Strategic Sourcing by electronic submission on September 5, 2018, until 2:00 p.m. (local time). The link for bid submission will be posted with the bid details at http://go.wayne.edu/bids beginning August 14, 2018.

No public bid opening will be held.

Bid Qualification Meeting: Bidders must be available for bid prequalification meeting the day following the bid opening. The lowest qualified bidder will be contacted and requested to meet with Facilities Planning & Management at their office located at 5454 Cass Avenue, Detroit, MI 48202. During the bid qualification, the Vendor must provide
a Project Schedule and a Schedule of Values, including a list of Contractor's suppliers, subcontractors and other qualifications.

An unsigned contract will be given to the successful Contractor at the conclusion of the bid qualification meeting, if all aspects of the bid are in order. The Contractor has 5 business days to return the contract to the Project Manager for University counter signature. The contractor must also submit a Performance Bond as outlined above and a Certificate of Insurance in the same 5 business day period. In the event the Contractor fails to return the documents in this 5 day period, the University reserves the right to award the contract to the next most responsive bidder.

All available information pertaining to this project will be posted to the Purchasing web site at http://go.wayne.edu/bids. Information that is not posted to the website is not available/not known.
INSTRUCTIONS TO BIDDERS

OWNER: Board of Governors
Wayne State University

PROJECT: Prentis Computer Lab Relocation 2018
Project No. 122-313456

LOCATION: Wayne State University
5201 Cass,
Detroit, Michigan 48202

OWNER’S AGENT: Robert Kuhn, Sr. Buyer
WSU – Procurement & Strategic Sourcing
5700 Cass, Suite 4200
Detroit, Michigan 48202
313-577-3712 / 313-577-3747 fax
ac6243@wayne.edu & copy leiann.day@wayne.edu

1. PROPOSALS

A. The Purchasing Agent will receive sealed Proposals for the work as herein set forth at the place and until the time as stated in the "Information for Bidders", a copy of which is bound herewith in these specifications. No public bid opening will be held.

B. Proposals shall be for a lump-sum General Contract for the entire work of the Project as provided in the Form of Proposal.

C. Proposals shall be submitted by electronic submission on forms furnished with the Bidding documents. The link for bid submission will be posted with the bid details at http://go.wayne.edu/bids beginning August 14, 2018. The forms must be fully filled out in ink or typewritten with the signature in longhand, and the completed forms shall be without alterations, interlineations, or erasures. Forms shall contain no recapitulations of the work to be done. Each proposal shall be delivered in an opaque sealed envelope, marked "PROPOSAL" and SHALL BEAR THE NAME OF THE PROJECT AND THE NAME OF THE BIDDER. Proposals submitted by telephone or telegraph will not be accepted. Modifications by telephone or telegraph to previously submitted proposals will not be accepted.

D. (revised 5-29-2009) All base bids must be conforming to the detailed specifications and drawings provided by the University, including any Addenda issued. Voluntary Alternates will only be considered if the Contractor has also submitted a conforming base bid. Any stipulation of voluntary alternates or qualifications contrary to the Contract requirements made by the Bidder in or accompanying his proposal as a condition for the acceptance of the Contract will not be considered in the award of the Contract and will cause the rejection of the entire Proposal.

E. The competency and responsibility of Bidders will be considered in making the award. The Owner does not obligate himself to accept the lowest or any other bids. The Owner reserves the right to reject any and all bids and to waive any informalities in the Proposals.

2. PROPOSAL GUARANTEE (revised 3-22-2012)

A. A certified check or bank draft payable to the Owner, or satisfactory Bid Bond executed by the Bidder and Surety Company, in an amount equal to not less than five percent (5%) of the maximum proposal amount shall be submitted with each Proposal, which amount may be forfeited to the Board of Governors, Wayne State University, if the successful Bidder refuses to enter into a Contract within ninety (90) days from receipt of Proposals.
INSTRUCTIONS TO BIDDERS

3. CONTRACT SECURITY (revised 3-22-2012)

A. The successful Bidder will be required to furnish a Performance Bond and Labor and Material Payment bond in an amount equal to 100% of the contract award amount, and include such cost in the Proposal, complying with the laws of the State of Michigan. The graduated formula no longer applies.

B. Performance Bond and Labor and Material Payment Bond shall be from a surety company acceptable to the Owner and made payable as follows:

(1) A bond for 100% of the contract award amount to the Board of Governors of Wayne State University, and guaranteeing the payment of all subcontractors and all indebtedness incurred for labor, materials, or any cause whatsoever on account of the Contractor in accordance with the laws of the State of Michigan relating to such bonds.

(2) A bond for 100% of the contract award amount to the Board of Governors of Wayne State University to guarantee and insure the completion of work according to the Contract.

C. The only acceptable Performance Bond shall be the AIA A312 – 2010.

D. Bond must be issued by a Surety Company with an “A rating as denoted in the AM Best Key Rating Guide”.

4. BOND CLARIFICATION

For bids below $50,000.00,

A. Bid bond will not be required.
B. Performance Bond will not be required.

5. INSPECTION

A. Before submitting his Proposal, each Bidder shall be held to have visited the site of the proposed work and to have familiarized himself as to all existing conditions affecting the execution of the work in accordance with the Contract Documents. No allowance or extra consideration on behalf of the Contractor will subsequently be made by reason of his failure to observe the Conditions or on behalf of any subcontractor for the same reason.

6. EXPLANATION TO BIDDERS AND ADDENDA

A. Neither the Owner nor Representative nor Purchasing Agent will give verbal answers to any inquiries regarding the meaning of drawings and specifications, and any verbal statement regarding same by any person, previous to the award, shall be unauthoritative.
B. Any explanation desired by Bidders must be requested of the Purchasing Agent in writing, and if explanation is necessary, a reply will be made in the form of an Addendum, a copy of which will be forwarded to each Bidder registered on the Bidders' List maintained by Procurement & Strategic Sourcing.

C. All addenda issued to Bidders prior to date of receipt of Proposals shall become a part of these Specifications, and all proposals are to include the work therein described.

7. INTERPRETATION OF CONTRACT DOCUMENTS

A. If any person contemplating submitting a bid for the proposed Contract is in doubt as to the true meaning of any part of the drawings, specifications, or other Contract Documents, he may submit to the Purchasing Agent, a written request for an interpretation thereof. The person submitting the request will be responsible for its prompt delivery. Any interpretation of the Contract Documents will be made by an addendum duly issued. A copy of such addendum will be mailed and delivered to each registered Bidder. Each proposal submitted shall list all addenda, by numbers, which have been received prior to the time scheduled for receipt of proposal.

8. SUBSTITUTION OF MATERIALS AND EQUIPMENT*

A. Whenever a material, article or piece of equipment is identified on the Drawings or in the Specifications by reference to manufacturers' or vendors' names, trade names, catalog numbers, or the like, it is so identified for the purpose of establishing a standard, and any material, article, or piece of equipment of other manufacturers or vendors which will perform adequately the duties imposed by the general design will be considered equally acceptable provided that the material, article, or piece of equipment so proposed is, in the opinion of the Architect, of equal substance, appearance and function. It shall not be purchased or installed by the Contractor without the Architect's written approval.

9. TAXES

A. The Bidder shall include in his lump sum proposal and make payment of all Federal, State, County and Municipal taxes, including Michigan State Sales and Use Taxes, now in force or which may be enacted during the progress and completion of the work covered. Information regarding the State of Michigan sales and use tax laws can be found in SOM Revenue Administrative Bulletin 2016-18.

10. REQUIREMENTS FOR SIGNING PROPOSALS AND CONTRACTS

A. The following requirements must be observed in the signing of proposals that are submitted:

(1) Proposals that are not signed by individuals making them shall have attached thereto a Power of Attorney, evidencing the authority to sign the Proposal in the name of the person for whom it is signed.

(2) Proposals that are signed for partnership shall be signed by all of the partners or by an Attorney-in-Fact. If signed by an Attorney-in-Fact, there must be attached to the Proposal a Power of Attorney evidencing authority to sign the Proposal, executed by the partners.

(3) Proposals that are signed for a corporation shall have the correct corporate name thereof and the signature of the President or other authorized officer of the corporation, manually written in the line of the Form of Proposal following the words "signed by". If such a proposal is signed by an official other than the President of the Corporation, a certified copy of resolution of the Board of Directors, evidencing the authority of such official to sign the bid, shall be attached to it. Such proposal shall also bear the attesting signature of the Secretary of the Corporation and the impression of the corporate seal.

11. QUALIFICATIONS OF BIDDERS
A. The Owner may request each of the three (3) low bidders to submit information necessary to satisfy the Owner that the Bidder is adequately prepared to fulfill the Contract. Such information may include past performance records, list of available personnel, plant and equipment, description of work that will be done simultaneously with the Owner’s Project, financial statement, or any other pertinent information. This information and such other information as may be requested will be used in determining whether a Bidder is qualified to perform the work required and is responsible and reliable.

12. SPECIAL REQUIREMENTS

A. The attention of all Bidders is called to the General Conditions, Supplementary General Conditions, and Special Conditions, of which all are a part of the Specifications covering all work, including Subcontracts, materials, etc. Special attention is called to those portions dealing with Labor Standards, including wages, fringe benefits, Equal Employment Opportunities, and Liquidated Damages.

B. Prior to award of the project, the apparent low bidder will be required to produce a schedule of values which will include the proposed subcontractors for each division of work and whether the subcontractor is signatory or non-signatory. A contract will not be issued to the apparent low bidder until this document is provided. A contractor will have one week to produce this document. If the required document is not received within this time, the bidder will be disqualified.


A. The Proposal shall be deemed as having been accepted when a copy of the Contract (fully executed by both the vendor and the appropriate signatory authority for the University), with any/all Alternates, Addenda, and Pre-Contract Bulletins, as issued by the office or agent of the Owner has been duly received by the Contractor. After signing the Contracts, the Contractor shall then return all copies, plus any required bonds and certificates of insurance, to the office of the Owner's Representative, at 5454 Cass, Wayne State University, Detroit, MI 48202. Construction will begin when the fully-executed contract has been returned to the Contractor.

14. TIME OF STARTING AND COMPLETION

A. It is understood that the work is to be carried through to substantial completion with the utmost speed consistent with good workmanship and to meet the established start and completion dates.

B. The Contractor shall begin work under the Contract without delay, upon receipt of a fully-executed contract from the Owner, and shall substantially complete the project ready for unobstructed occupancy and use of the Owner for the purposes intended within the completion time stated in the Contract.

C. The Contractor shall, immediately upon receipt of fully-executed contract, schedule his work and expedite deliveries of materials and performance of the subcontractors to maintain the necessary pace for start and completion on the aforementioned dates.

15. CONTRACTOR’S PERFORMANCE EVALUATION (2-2015)

In an effort to provide continuous process improvement regarding the construction of various university projects, Wayne State University is embarking upon a process of evaluating the contractor’s overall performance following the completion of work. At the conclusion of the construction project a subjective evaluation of the Contractor’s performance will be prepared by the Project Manager and the supervising Director of Construction. The evaluation instrument that will be used in this process is shown in Section 00440-01 - Contractor’s Performance Evaluation.

16. BIDDING DOCUMENTS
A. Bid specifications are not available at the University, but are available beginning **August 14, 2018** through Wayne State University Procurement & Strategic Sourcing’s Website for Advertised Bids: [http://go.wayne.edu/bids](http://go.wayne.edu/bids). The plans for this project can be viewed in advance and/or printed from the above website. Copies of the RFP will not be available at the pre-proposal meeting.

B. **DOCUMENTS ON FILE (revised 12-2007)**

1. Wayne State University Procurement & Strategic Sourcing’s Website.
   All available information pertaining to this project will be posted to the Purchasing website at [http://go.wayne.edu/bids](http://go.wayne.edu/bids).
   Information that is not posted to the website is not available/not known.

2. Notification of this Bid Opportunity has been sent to those entities registered with our ListServ. Available ListServs can be found at [http://www.forms.procurement.wayne.edu/Adv_bid/Adv_Bid_Listserve.html](http://www.forms.procurement.wayne.edu/Adv_bid/Adv_Bid_Listserve.html)

3. Please note: Effective December 1, 2007, bid notices will be sent only to those Vendors registered to receive them via our Bid Opportunities list server. To register, to [http://go.wayne.edu/bids](http://go.wayne.edu/bids), and click on the “Join our Listserve” link at the top of the page.

15. **Smoke and Tobacco-Free Policies (9-2015)**

On August 19, 2015, Wayne State joined hundreds of colleges and universities across the country that have adopted smoke- and tobacco-free policies for indoor and outdoor spaces. Contractors are responsible to ensure that all employees and all subcontractors’ employees are in compliance anytime they are on WSU’s main, medical, or extension center campuses. The complete policy can be found at [http://wayne.edu/smoke-free/policy/](http://wayne.edu/smoke-free/policy/).
NOTICE OF MANDATORY PRE-BID CONFERENCE

PROJECT: Prentis Computer Lab Relocation 2018,

PROJECT NOS.: WSU PROJECT NO. 122-313456

It is MANDATORY that each Contractor proposing to bid on this work must attend a pre-bid conference at the following location:

Wayne State University
5454 Cass, Conference Room 3
Detroit MI 48202

10:00 AM, local time, August 21, 2018

Please use our online registration form at https://forms.wayne.edu/5aa587e3de04c#form-9162, to indicate your attendance at our mandatory Pre-proposal meeting to be held on, August 21, 2018 at 10:00 AM and your intent to submit a proposal for the services listed.

The purpose of this conference is to clarify the procedures, scope of work, and to identify any omissions and/or inconsistencies that may impede preparation and submission of representative competitive bids.

In the event that less than 4 individual contractor firms attend the pre-bid conference, the University reserves the right, at its sole discretion, to either reschedule the pre-bid conference or proceed and offer a second pre-bid conference date. (Attendance at only one pre-bid conference will be required).

An attendance list shall be prepared and minutes of the conference shall be furnished to all those attending.

Any clarifications or corrections that cannot be made at the conference will be by Addendum.

For your convenience a map of the University and appropriate parking lots can be downloaded and printed from: http://campusmap.wayne.edu. Guest parking in any of the University student and guest lots is $8.00. A detailed list of Cash & Coin operated lots can be viewed at http://procurement.wayne.edu/cash_and_credit_card_lots.php. Cash lots dispense change in quarters. Due to time constraints, Vendors are encouraged to avoid parking at meters on the street (especially blue “handicapped” meters).

All available information pertaining to this project will be posted to the Purchasing web site at http://go.wayne.edu/bids.
Information that is not posted to the website is not available/not known.
AGENDA

I. Welcome and Introductions
   A. Wayne State University Representatives
   B. Vendor Representatives
   C. Sign in Sheet- be sure to include your company name and representative in attendance on the sign in sheet.

II. Brief Overview of Wayne State University
   A. Purpose and Intent of RFP.
   B. Detailed review of the RFP and the requirements for a qualified response.
   C. Review of all pertinent dates and forms that are REQUIRED for a qualified response.

III. Vendor Questions/Concerns/Issues
   A. Questions that can be answered directly by the appropriate person in this meeting will be answered and both question and answer will be recorded in the minutes of the meeting.
   B. Questions that need to be researched will be answered and a nature of clarification will be emailed to the appropriate ListServ. See http://www.forms.purchasing.wayne.edu/Adv_bid/Adv_Bid_Listserve.html for a list of ListServ Bid Lists.
   C. Minutes will be emailed to the appropriate ListServ.
   D. Questions and concerns that come up after this meeting are to be addressed to Robert Kuhn, Procurement & Strategic Sourcing. Discussion with other University members is seriously discouraged and could lead to disqualification from further consideration. All questions and answers will be recorded and emailed to all participants of the RFP.
   E. Due date for questions is August 27, 2018, 12:00 noon.

IV. Minimum Participation
   A. Pre-registration for the Pre-Bid meeting is required. In the event that we do not have four (4) or more eligible bidders pre-registered, the University reserves the right to postpone the Pre-bid meeting with up to 4 business hour notice.
   B. If less than 4 individual contractor firms attend the mandatory pre-bid meeting, the University reserves the right, at its sole discretion, to either reschedule the pre-bid conference or proceed and offer a second pre-bid conference date. (Attendance at only one pre-bid conference will be required).
   C. On the day of the bid opening, if less than 3 sealed bids are received, the University reserves the right, at its sole discretion, to rebid the project in an effort to obtain greater competition. If the specifications are unchanged during the rebid effort, any contractor who submitted a bid will be given the option of keeping its bid on file for opening after the second bid effort, or of having the bids returned to them unopened.

V. Proposal Due Date- September 5, 2018, 2:00 p.m.

VI. Final Comments

VII. Adjourn
Sealed proposals for lump-sum General Contract will be received at the office of the Procurement & Strategic Sourcing by electronic submission on September 5, 2018, until 2:00 p.m. (local time). The link for bid submission will be posted with the bid details at http://go.wayne.edu/bids beginning August 14, 2018.

Please Note – Vendors must Pre-qualify themselves when responding to this bid opportunity. Our Prequalification questions can be found on page 4 of this section.

OWNER: Board of Governors
Wayne State University

PROJECT: Prentis Computer Lab Relocation 2018

PROJECT NO.: WSU PROJECT NO. 122-313456

PROJECT TYPE: General construction including architectural, electrical, mechanical (HVAC & piping) Work

PURCHASING AGENT: Robert Kuhn, Sr. Buyer
WSU – Procurement & Strategic Sourcing
5700 Cass, Suite 4200
Detroit, Michigan 48202
313-577-3712/ 313-577-3747 fax
ac6243@wayne.edu & copy leiann.day@wayne.edu

OWNER'S REPRESENTATIVE: T. Allen Gigliotti, Project Manager
Design & Construction Services
Facilities Planning & Management
Wayne State University
5454 Cass Avenue
Detroit, Michigan 48202

TO: Board of Governors
Wayne State University
Detroit, Michigan

BASE PROPOSAL: The undersigned agrees to enter into an Agreement to complete the entire work of the **Prentis Computer Lab Relocation 2018** project (WSU Project No. 122-313456) in accordance with the Bidding Documents for the following amounts:

| $ | Dollars |

LAWN REPLACEMENT: The undersigned agrees that, in the event of existing lawn or landscaping damage, due to the Contractor's work, that has not been properly addressed and repaired to the satisfaction of the University, the University may repair/replace the lawn and/or landscaping, and that the expense will be at a unit cost of $10.00 per square yard for lawn, and landscaping at a rate of 1.5 times the cost of said repairs, the full cost of which shall be reimbursed by the contractor.

CONTRACT CHANGE ORDERS: The undersigned agrees to the following pricing formula and rates for changes in the contract work:
Where changed Work is performed, the Contractor may add to the total estimated actual cost for such Work no more than ten (10%) for subcontractor mark-up and seven and one-half percent (7.5%) for self-performed trade work for profit, overhead, insurance, taxes, indirect supervision, bonds, and any other costs not allowed by section 4.02.01

Within 14 days of the project’s contract execution Contractor shall provide to the Owner; Subcontractor’s hourly labor rate breakdown details. This requirement shall extend to the lowest level of subcontractor participation.

* Job and general overhead includes supervision and executive expenses; use charges on small tools, scaffolding, blocking, shores, appliances, etc., and other miscellaneous job expenses.

** Net labor cost is the sum of the base wages, fringe benefits established by governing trade organizations, applicable payroll taxes, and increased expense for contractor's liability insurance (Workman's Compensation, P.L. and P.D.).

**TIME OF COMPLETION:** *(revised 4-01-2011)*
The Contract is expected to be fully executed on or about 25 calendar days after successful bidder qualification and recommendation of award. The undersigned agrees to start construction immediately after receipt of a fully executed contract, and to complete the work as follows:

Substantial Completion will be completed no later than 12/14/2018.

**LIQUIDATED DAMAGES:**
It is understood and agreed that, if project is not completed within the time specified in the contract plus any extension of time allowed pursuant thereto, the actual damages sustained by the Owner because of any such delay, will be uncertain and difficult to ascertain, and it is agreed that the reasonable foreseeable value of the use of said project by Owner would be the sum of $500.00, Five Hundred Dollars per day, and therefore the contractor shall pay as liquidated damages to the Owner the sum of $500.00, Five Hundred Dollars per day for each day's delay in substantially completing said project beyond the time specified in the Contract and any extensions of time allowed thereunder.

**TAXES:**
The undersigned acknowledges that prices stated above include all applicable taxes of whatever character or description. Michigan State Sales Tax is applicable to the work. Bidder understands that the Owner reserves the right to reject any or all bids and to waive informalities or irregularities therein.

**ADDENDA:**
The undersigned affirms that the cost of all work covered by the following Addenda are included in the lump sum price of this proposal.

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**CONTRACTOR’S PREQUALIFICATION STATEMENT & QUESTIONNAIRE:**

*Our Minimum Requirements for Construction Bids are:*

WSU considers this project: General construction including architectural, electrical, mechanical (HVAC & piping) Work.
### Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Small Project bid less than $50,000</th>
<th>Medium Project bid between $50,001 and $250,000</th>
<th>Large Project bid between $250,001 and $2 million</th>
<th>Very Large Project bid greater than $2 million</th>
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<tbody>
<tr>
<td>EMR Rating (Experience Modification Rating)</td>
<td>1.0 or Less</td>
<td>1.0 or Less</td>
<td>1.0 or Less</td>
<td>1.0 or Less</td>
</tr>
<tr>
<td>Bondable Vendor</td>
<td>N.A.</td>
<td>Required</td>
<td>Required</td>
<td>Required</td>
</tr>
<tr>
<td>Length of Time in Construction Business</td>
<td>2 Years</td>
<td>3 Years</td>
<td>5 Years</td>
<td>5 Years</td>
</tr>
<tr>
<td>Demonstrated Experience in Projects Similar in Scope and Price in the last 3 years</td>
<td>1 or more</td>
<td>1 or more</td>
<td>2 or more</td>
<td>3 or more</td>
</tr>
<tr>
<td>Unsuccessful Projects on Campus in last 3 years</td>
<td>None Allowed</td>
<td>None Allowed</td>
<td>None Allowed</td>
<td>None Allowed</td>
</tr>
<tr>
<td>Failure to comply with Prevailing Wage and/or Project Labor requirements</td>
<td>None Allowed</td>
<td>None Allowed</td>
<td>None Allowed</td>
<td>None Allowed</td>
</tr>
<tr>
<td>Withdrawn University Bid (with or without Bond forfeiture) within the last 3 years **</td>
<td>1 or less</td>
<td>1 or less</td>
<td>1 or less</td>
<td>1 or less</td>
</tr>
<tr>
<td>Company currently not in Chapter 11 of the US Bankruptcy Code</td>
<td>1 Year</td>
<td>2 Years</td>
<td>3 Years</td>
<td>3 Years</td>
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** Withdrawal of a bid is subject to the University suspension policy, for a period up to one year.

**Contractors must complete the following information to determine their eligibility to participate in this bid.** This information is required with your Bid to the University.

**Failure to complete this form in its entirety will result in your bid being disqualified.**

Check one of the following on the makeup of your company:

- [ ] Corporation
- [ ] Individual
- [ ] Partnership
- [ ] Joint Venture
- [ ] Other (Explain below):

**Diversity Classification:** Please indicate the appropriate diversity classification for your company. The University recognizes the following groups as diverse or disadvantaged:

- Majority Owned
- Minority Business Enterprises (MBE)
- Women Business Enterprises (WBE)
- Disabled Veteran Enterprises (DVBE)
- Disabled Person Enterprises (DBE)
- Veteran Owned Businesses (VBE)
• Small Businesses per the US Small Business Administration (SBE)  ____________
• Other (Please Explain): _______________  ____________

1. How many years has your organization been in business as a contractor? ____________

2. How many years has your organization been in business under its present business name? ____________

3. List states in which your organization is legally qualified to do business. ____________

4. Provide the Name and Address of your Liability Insurance Carrier. ____________

5. What is your current EMR Rating?
   The minimum requirement is an EMR Rating of 1.0 or less for all projects. Bidders with a rating higher than 1.0 understand that their bid may be disqualified, at the sole discretion of the University.

6. What percentage of work performed on projects are by company employees; excluding any hired subcontracting and outsourced relationships, for the bid submitted? _______ %

7. What percentage of work performed on your companies behalf are by subcontracted business relationships; disallowing 1099 contracting work forces, for the bid submitted? _______ %

8. Have you ever failed to complete any work awarded to you? If so, attach a separate sheet of explanation. Include the name of the Project, the customer, the dates of the work, and the amount of the contract?

9. Have you withdrawn a bid after a University bid opening and/or refused to enter into a contract with the University upon notification of award within the last 3 years? If so, state the Project Name and Number, and the date of bid submission below.

10. Has any officer or partner of your organization ever been an officer or partner of another organization that failed to complete a construction contract? If so, attach a separate sheet of explanation.

11. List the construction experience of the principals and superintendents of your company.

   Name: ___________________________ Title: ___________________________
   _________________________________________________________________
   ___________________________
   Name: ___________________________ Title: ___________________________
   _________________________________________________________________
   ___________________________
   Name: ___________________________ Title: ___________________________
   _________________________________________________________________

12. List the construction Projects, and approximate dates, when you performed work similar in Scope to this project.
Project: ___________________________ Owner: ___________________________
Contract Amount: ___________________________ Date Completed: ________________

Project: ___________________________ Owner: ___________________________
Contract Amount: ___________________________ Date Completed: ________________

Project: ___________________________ Owner: ___________________________
Contract Amount: ___________________________ Date Completed: ________________

13. List the construction Projects, and approximate dates, when you performed work similar in Dollar Amount to this project.

Project: ___________________________ Owner: ___________________________
Contract Amount: ___________________________ Date Completed: ________________

Project: ___________________________ Owner: ___________________________
Contract Amount: ___________________________ Date Completed: ________________

Project: ___________________________ Owner: ___________________________
Contract Amount: ___________________________ Date Completed: ________________

14. Is your Company “bondable”? Yes ______ No ______

15. What is your present bonding capacity? $ ___________________________

16. Who is your bonding agent?
NAME: ________________________________________________________________
ADDRESS: ______________________________________________________________
PHONE: ( ) ___________________________
CONTACT: ______________________________________________________________

17. Does your company agree to provide financial reports to the University upon request? Failure to agree may result in disqualification of your bid. Yes ______ No ______

18. Does your company agree that all of the Terms and Conditions of this RFP and Vendor’s Response Proposal become part of any ensuing agreement? Yes ______ No ______

19. Does your company agree to execute a contract containing the clauses shown in Section 00500 “Agreement Between Contractor and Owner for Construction”? Yes ______ No ______

If "No", clearly note any exceptions to any information contained in the contract documents and include with your proposal.

20. Did your company quote based upon Prevailing Wage Rates? Yes ______ No ______

21. Does your company agree to comply with the University Smoke and Tobacco Free Policies? Yes ______ No ______

Note: Contractors submitting proposals for this project may, at the discretion of the University, be required to submit references including contact information to be used to assist in the post bid evaluation process for the subject project.
ACKNOWLEDGEMENT OF
MINIMUM QUALIFICATIONS:
The undersigned has read and understands the minimum qualifications for University construction projects, and has completed the Prequalification section completely and accurately. The undersigned understands that a contractor, who fails to meet the minimum qualifications in the category identified for this project, will be disqualified from consideration for the project.

ACCEPTANCE OF PROPOSAL:
The undersigned agrees to execute a Contract, being the Wayne State University standard form titled "Agreement Between Contractor and Owner for Construction" (see section 00500 of the bid documents), provided that we are notified of the acceptance of our Proposal within sixty (60) days of the date set for the opening thereof.

The undersigned below understands that the bid will be disqualified if the Prequalification information above is not completed in its entirety.

NAME OF COMPANY: ____________________________________________

OFFICE ADDRESS: ____________________________________________

PHONE NUMBER: _________________ DATE ________________

FAX NUMBER: ____________________________________________

SIGNED BY: ____________________________________________

Signature

(Please print or type name here)

TITLE ____________________________________________

EMAIL ADDRESS: __________________________________@
PREVAILING WAGE RATE SCHEDULE (revised 4-05-2010)

A. See also Page 00100-4 Section 12.B

B. Wayne State University requires all project contractors, including subcontractors, who provide labor on University projects to compensate at a rate no less than prevailing wage rates.

C. The rates of wages and fringe benefits to be paid to each class of laborers and mechanics by each VENDOR and subcontractor(s) (if any) shall be not less than the wage and fringe benefit rates prevailing in Wayne County, Michigan, as determined by the United States Secretary of Labor. Individually contracted labor commonly referred to as "1099 Workers" and subcontractors using 1099 workers are not acceptable for work related to this project.

D. Certified Payroll must be provided for each of the contractor’s or subcontractor's payroll periods for work performed on this project. Certified Payroll should accompany all Pay Applications. Failure to provide certified payroll will constitute breach of contract, and pay applications will be returned unpaid, and remain so until satisfactory supporting documents are provided.

A Prevailing Wage Rate Schedule is enclosed as Appendix A.

Additional information can be found on the University Procurement & Strategic Sourcing's web site at the following URL address:

http://procurement.wayne.edu/vendors/wage-rates.php

E. Wayne State University's Prevailing Wage Requirements:

When compensation will be paid under prevailing wage requirements, the University shall require the following:

A. The contractor shall obtain and keep posted on the work site, in a conspicuous place, a copy of all current prevailing wage and fringe benefit rates.

B. The contractor shall obtain and keep an accurate record showing the name and occupation of and the actual wages and benefits paid to each laborer and mechanic employed in connection with this contract.

C. The contractor shall submit a completed certified payroll document [U.S. Department of Labor Form WH 347] verifying and confirming the prevailing wage and benefits rates for all employees and subcontractors for each payroll period for work performed on this project. The contractor shall include copies of pay stubs for all employee or contract labor payments related to Wayne State University work. The certified payroll form can be downloaded from the Department of Labor website at http://www.dol.gov/whd/forms/wh347.pdf.

D. A properly executed sworn statement is required from all tiers of contractors, sub-contractors and suppliers which provide services or product of $1,000.00 or greater. Sworn statements must accompany applications for payment. All listed parties on a sworn statement and as a subcontractor must submit Partial or Full Conditional Waivers for the amounts invoiced on the payment application. A copy of the acceptable WSU Sworn Statement and Waiver will be provided to the awarded contractor.

E. Apprentices for a skilled trade must provide proof of participation in a Certified Apprenticeship Program and the level of hours completed in the program.

F. Daily project sign-in sheets and field reports for the project must be turned in weekly.

Note: Contractor invoices WILL NOT be processed until all listed certified payroll documents are received.

G. If the VENDOR or subcontractor fails to pay the prevailing rates of wages and fringe benefits and does not cure such failure within 10 days after notice to do so by the UNIVERSITY, the UNIVERSITY shall have the right, at its option, to do any or all of the following:
1. Withhold all or any portion of payments due the VENDOR as may be considered necessary by the UNIVERSITY to pay laborers and mechanics the difference between the rates of wages and fringe benefits required by this contract and the actual wages and fringe benefits paid.

2. Terminate this contract and proceed to complete the contract by separate agreement with another vendor or otherwise, in which case the VENDOR and its sureties shall be liable to the UNIVERSITY for any excess costs incurred by the UNIVERSITY.

3. Propose to the Director of Purchasing that the Vendor be considered for Debarment in accordance with the University's Debarment Policy, found on our website at http://procurement.wayne.edu/docs/appm28.pdf

Terms identical or substantially similar to this section of this RFP shall be included in any contract or subcontract pertaining to this project.

H. Prior to award of the project, the apparent low bidder will be required to produce a schedule of values which will include the proposed subcontractors for each division of work and whether the subcontractor is signatory or non-signatory. A letter of intent or contract will not be issued to the apparent low bidder until this document is provided. The apparent low bidder will have one week to produce this document. If the required document is not received within this time, the bidder will be disqualified, and the next low bidder will be required to provide this schedule of values.

APPENDIX A FOR THE PREVAILING WAGE SCHEDULE FOR THIS PROJECT

See web site:
http://go.wayne.edu/bids
APPENDIX A FOR THE
PREVAILING WAGE SCHEDULE FOR THIS PROJECT

See web site:

http://go.wayne.edu/bids
The University tracks it’s level of spend along a number of socio-economic categories. This includes it’s spend with Diverse organizations, it’s spend with Detroit based organizations, and it’s spend with Michigan based organizations. To assist with this, The University has the following requirements for submission of your bid and for Pay Applications submitted by the successful contractor.

**Submission of Bid**

1. **Diverse or disadvantaged prime contractor:** Please specify in your bid whether ownership of your company is a certified diverse or disadvantaged business, according to the categories listed previously in section 00300. In accordance with guidelines from the MMSDC and GL-WBC, the University considers a business to be diverse when it is at least 51% owned, operated, and controlled by one or more members of a diverse classification. Section 00300 has a place for this information on page 00300-3.

2. **Detroit based and Michigan Based contractor:** It is presumed that the contractor is headquartered at the location we submit our Purchase Orders to, and that it should be the same address as listed in Section 00300 at the signature line. If a supplier is headquartered elsewhere, please make note of this information, so we do not inaccurately include or exclude spend.

**Pay Applications and Sworn Statements**

1. **Applicability:** The University requires Sworn Statements with Pay Applications for all construction projects that use
   - Subcontractors greater than $1,000.00
   - Significant suppliers (those with a purchase value of $1,000 or more).

2. **Sworn Statements:** The Supplier must submit applicable monthly sworn statements to the Project Manager and the Buyer of Record, in the format shown on page 2 of Section 00420. Sworn Statements are “always required” for this project, and are to be submitted to **(Project Manager)**, the project manager, and to **Robert Kuhn, Sr. Buyer**

3. **Inclusion:** Sworn Statements are to detail the inclusion of recognized diverse and disadvantaged groups in the following 2 categories; Subcontracts or Suppliers. The University recognizes the following groups as diverse or disadvantaged:
   - Minority Business Enterprises (MBE)
   - Women Business Enterprises (WBE)
   - Disabled Veteran Enterprises (DVBE)
   - Disabled Person Enterprises (DBE)
   - Veteran Owned Businesses (VBE)
   - Small Businesses per the US Small Business Administration (SBE)

4. A complete set of the University's Supplier Diversity Program, which includes complete definitions of each of the above, can be downloaded from our web site at [http://policies.wayne.edu/administrative/04-02-supplier-diversity.php](http://policies.wayne.edu/administrative/04-02-supplier-diversity.php).
Prentis Computer Lab Relocation 2018  
WSU Project No. 122-313456

STATE OF MICHIGAN  
COUNTY OF ___________________________  

$  

I, ___________________________, being duly sworn, deposes and says that (she makes the Sworn Statement on behalf of ____________________________, who is the Contractor for an improvement to the following described real property situated in ____________________________, County, Michigan, and described as follows:

That the following is a statement of each subcontractor and supplier and laborer, for which laborer the payment of wages or fringe benefits and withholdings is due but unpaid, with whom ___________________________ has subcontracted for performance under the contract with the Owner or lessor thereof, and that the amounts due to the persons as of the date thereof are correctly and fully set forth opposite their names, as follows. (Subcontracts or suppliers of values of less than $1,000 are omitted.)

<table>
<thead>
<tr>
<th>NO.</th>
<th>SUBCONTRACTOR</th>
<th>TYPE OF ENTITY</th>
<th>TYPE OF IMPROVEMENT</th>
<th>TOTAL CONTRACT PRICE</th>
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* Type of Entity: MBE=Minority Business Enterprises; WBE=Women Business Enterprises; DBE=Disabled Veteran Enterprises; DBE=Disabled Person Enterprises; VBE=Veteran Owned Businesses;  
  SBE=Small Businesses per the US Small Business Administration

Please attach additional sheets if the number of items exceeds the page limit.
That __________________________________________________________ has not procured material from, or subcontracted with, any person other than those set forth above and owes no money for the improvement.

Dependent further says that __________________________________________ makes the foregoing statement as a representative of ________________________________ for the purpose of representing to the owner or lessor of the above-described premises and his or her agents that the above-described property is free from claims of construction liens, or the possibility of construction liens, except as specifically set forth above and except for claims of construction liens by laborers which may be provided pursuant to section 109 of the construction lien act, Act No. 497 of the Public Acts of 1980, as amended, being section 570.1109 of the Michigan Compiled Laws.

Dependent Signature

WARNING TO OWNER: AN OWNER OR LESSEE OF THE ABOVE-DESCRIBED PROPERTY MAY NOT RELY ON THIS SWEORN STATEMENT TO AVOID THE CLAIM OF A SUBCONTRACTOR, SUPPLIER, OR LABORER WHO HAS PROVIDED A NOTICE OF FURNISHING OR A LABORER WHO MAY PROVIDE A NOTICE OF FURNISHING PURSUANT TO SECTION 109 OF THE CONSTRUCTION LIEN ACT TO THE DESIGNEE IS NOT NAMED OR HAS DIED.

ON RECEIPT OF THIS SWEORN STATEMENT, THE OWNER OF LESSEE, OR THE OWNER'S OR LESSEE'S DESIGNEE, MUST GIVE NOTICE OF ITS RECEIPT, EITHER IN WRITING, BY TELEPHONE, OR PERSONALLY, TO EACH SUBCONTRACTOR, SUPPLIER AND LABORER WHO HAS PROVIDED A NOTICE OF FURNISHING UNDER SECTION 109 OR, IF A NOTICE OF FURNISHING IS EXCUSED UNDER SECTION 108 OR 108A, TO EACH SUBCONTRACTOR, SUPPLIER OR LABORER WHO HAS PROVIDED A NOTICE OF FURNISHING OR WHO IS NAMED IN THIS SWEORN STATEMENT MAKES A REQUEST, THE OWNER, LESSEE, OR DESIGNEE SHALL PROVIDE THE REQUESTER A COPY OF THIS SWEORN STATEMENT WITHIN 10 BUSINESS DAYS AFTER RECEIVING THE REQUEST.

WARNING TO DEPENDENT: A PERSON, WHO WITH INTENT TO DEFRAUD, GIVES A FALSE STATEMENT IS SUBJECT TO CRIMINAL PenALTIES AS PROVIDED INS SECTION 110 OF THE CONSTRUCTION LIEN ACT, ACT NO. 497 OF THE PUBLIC ACTS OF 1980, AS AMENDED, BEING SECTION 570.2220 IF THE MICHIGAN COMPILED LAWS.

Subscribed and sworn to before me this __________ day of ________________

Notary Public

______________________________

County, Michigan - My commission expires: ________________________________

Rev. 06.05.15
WAYNE STATE UNIVERSITY
PAYMENT PACKAGE DOCUMENT REQUIREMENTS (Revised 7-23-2015):

Review and comply with Section 410 of Bid Front End Documents.
Review and comply with Article 15 of the Supplemental General Conditions.

PAYMENT APPLICATION - AIA document G702 & G703 (or equivalent) –Checklist:
  - Correct Project Name – Found on your contract.
  - Correct Project Number – Found on your contract.
  - Purchase Order Number – Required prior to beginning work.
  - Correct Application Number.
  - Correct Period Reporting Dates – Applications support docs must be sequential and within application range.
  - Approved & Executed Change Orders Listed. (Cannot invoice for unapproved Change Orders)
  - Schedule of Values percentages and amounts match the approved Pencil Copy Review – Signed by the Architect, Contractor, and University Project Manager.
  - Correct Dates – Back dating not accepted.
  - Signed and Notarized.

SWORN STATEMENT – Checklist:
  - List all contractors, sub-contractors, suppliers… ≥ $1000.00
  - A sworn statement is required from every Sub Contractor on the job with a material purchase or sub-contract of $1,000 or more. (All tiers.)
  - Purchase Order Number
  - Dates – Back dating not accepted.
  - Signed and Notarized.

CERTIFIED PAYROLL - Dept. of Labor Form WH-347 – Checklist: (Union and Non-Union)
  - For every contractor & sub-contractors work, for each week within the application reporting period.
  - Correct Project Number
  - List ALL workers on-site.
  - Make sure their addresses are listed.
  - Social Security Numbers MUST be blackened out or listed in XXX-XX-1234 format.
  - Work classifications based on the job specific Prevailing Wage Schedule descriptions.
  - For any workers paid at the Apprenticeship rates - proof of enrolled program and current completion required.
  - Rate of Pay verified against the Prevailing Wage Schedule with an hourly cost breakdown of fringes paid.
  - Authorized signatures on affidavit.
  - Dates – must represent the weeks within the application period.

APPLICATION PACKAGE SUPPORTING DOCUMENTATION –
  - Copies of Pay Stubs for each Certified Payroll period reported may be required– (Social Security Numbers MUST be blackened out or listed in XXX-XX-1234 format. Pay stubs need to reflect claimed participation of fringes like Medical, Dental, Retirement or 1099 classification.)
  - Proof of Ownership for any ‘Owner Operator’ contractors not wishing to claim their time on prevailing wage. – (Must list their hours and dates worked on the WH-347 Form and enter EXEMPT on the income brackets.) The Owner must provide copies of “DBA” registration form confirming status as exempt from prevailing wage requirements.
o **Proof of Stored Materials** – Bill of Lading, Delivery Receipts, Pictures, Certificate of Insurance or endorsement pate specifically insuring stored material at location, and pictures with materials clearly separated and labeled for WSU. The University reserves the right to on site verification of stored materials.

o **Partial Conditional Waivers** – The contractor shall provide covering the entire amount of the application. For non-bonded projects all sub-contractors must provide for all applications which they have a draw.

o **Partial Unconditional Waivers** – Must release amount paid for work and be delivered starting with application #2 and in no case after payment application #3, through all sequential applications for contractors, sub-contractors, and suppliers listed on the Sworn Statements.

o **Full Unconditional Waivers** – Must be delivered with final payment application, releasing all contractors, sub-contractors, suppliers listed on the sworn statements and any legitimate notice of furnishings reconciled.

**FINAL PAYMENT APPLICATION – Checklist:**
- Clear and concise As-Built drawings.
- Operation and Maintenance Manuals
- Process and training directions (if applicable).
- Warranty of work in accordance with project documents.
- Submittals log and samples installed on the job.
- Certificate of Substantial Completion
- Full Unconditional Waiver

The Project Manager may provide additional requirements as may apply to individual jobs

Revised 7-23-2015
Contractor Performance Evaluation

In an effort to provide continuous process improvement regarding the construction of various university projects, Wayne State University is embarking upon a process of evaluating the contractor’s overall performance following the completion of work. At the conclusion of the construction project a subjective evaluation of the Contractor’s performance will be prepared by the Project Manager and the supervising Director of Construction. The evaluation instrument that will be used in this process is presented below:
## Contractor Evaluation Sheet

<table>
<thead>
<tr>
<th>Field Management</th>
<th>Score</th>
<th>Weight</th>
<th>Total</th>
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<tbody>
<tr>
<td>1) Work Planning / Schedule:</td>
<td>1 2 3 4 5</td>
<td>8</td>
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<tr>
<td>2) Compliance with Construction Documents:</td>
<td>1 2 3 4 5</td>
<td>8</td>
<td></td>
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<tr>
<td>3) Safety Plan &amp; Compliance:</td>
<td>1 2 3 4 5</td>
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<td>4) Compliance with WSU procedures:</td>
<td>1 2 3 4 5</td>
<td>7</td>
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<tr>
<td>5) Effectiveness of Project Supervision:</td>
<td>1 2 3 4 5</td>
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<tr>
<td>6) Project Cleanliness:</td>
<td>1 2 3 4 5</td>
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<td>7) Punch List Performance:</td>
<td>1 2 3 4 5</td>
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<td>8) Contractor Coordination with WSU Vendors:</td>
<td>1 2 3 4 5</td>
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<td>9) Construction Quality:</td>
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### Administrative Management

| 10) Responsiveness: | 1 2 3 4 5 | 4 |   |
| 11) Contractor communication: | 1 2 3 4 5 | 4 |   |
| 12) Contractor Professionalism: | 1 2 3 4 5 | 3 |   |
| 13) Subcontractor Professionalism: | 1 2 3 4 5 | 3 |   |
| 14) Compliance with Contract Requirements: | 1 2 3 4 5 | 3 |   |
| 15) Submittal/RFI Process: | 1 2 3 4 5 | 4 |   |
| 16) Close-out - Accuracy of Documents | 1 2 3 4 5 | 7 |   |

### Invoice and Change Management

| 17) Change Management | 1 2 3 4 5 | 7 |   |
| 18) Applications for Payment | 1 2 3 4 5 | 6 |   |
| 19) Timely payment of Subs/Suppliers: | 1 2 3 4 5 | 4 |   |

### Evaluator

<table>
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<th>Signature</th>
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**CONTRACTOR’S EVALUATION EVALUATION**

Prentis Computer Lab Relocation 2018
WSU Project No. 122-313456
We are providing the evaluation instrument at this time to allow the bidder’s to review and understand the criterion that the University’s project management team will use to evaluate the successful bidder’s performance at the conclusion of the project. It is the intent of the university to utilize the results of this evaluation to determine if it will continue to conduct business with the Contractor in future bidding opportunities.

The scoring range is between 100 to 500 points, with 100 being low and 500 being high. Each question has an associated ‘weight’ factor, and the higher the weight; the greater the importance of satisfactory performance on the final score. At the conclusion of the project, and after the Project Manager and the supervising Director has prepared their independent evaluation, the University’s project representative will meet with the Contractor to review the results. Acceptable contractor performance is essential to avoid having the University decline future work with the Contractor. An appeals process is available for Contractor disagreement with evaluation scores.

Contractors engaged in work are encouraged to maintain an open and regular dialog with the Design and Construction Department over the course of the construction project to ensure that the final evaluation is an accurate representation of the Contractor’s performance.
CONSOLIDATED AGREEMENT FOR CONSTRUCTION GENERAL CONTRACTING

BOARD OF GOVERNORS OF WAYNE STATE UNIVERSITY
DETROIT, MICHIGAN

With

[GENERAL CONTRACTOR’S NAME]

For

[NAME PROJECT]

Wayne State University Contract Number _________

This Agreement is entered into on ___________________, 20__, by and between the Board of Governors of Wayne State University, called "University" in this Agreement, and [CONTRACTOR NAME], called "Contractor" in this Agreement, to provide construction labor and materials as outlined in the Bid accepted [ENTER DATE HERE], attached to this Agreement as Exhibit A, for the Project described in this Agreement.

[ENTER A BRIEF DESCRIPTION OF THE PROJECT]
1.00 CONTRACT DOCUMENTS

The Contract Documents shall consist of this Agreement, the Contractor's Bid or Proposal attached to this Agreement as Exhibit A only insofar as consistent with the other Contract Documents, the General Conditions of Construction, the Supplementary General Conditions, the approved plans and specifications, and other documents listed in Article 11, Inclusion by Reference. In the case of conflicts between the Contractor's Bid and this Agreement or other Contract Documents, the language of this Agreement and the other Contract Documents shall prevail over the Contractor's Bid or Proposal.

2.00 DESIGN PROFESSIONAL

The Design Professional for this Project is:

[NAME]
[ADDRESS]

The University intends that the relationship between the Contractor, Design Professional and University will be one of mutual cooperation and respect in order to promote efficiency and quality in the Project work.

3.00 CONTRACTOR'S RESPONSIBILITIES

3.01 Scope of Work

The Contractor shall furnish all labor, materials, equipment, project management and construction superintendent services necessary to construct the Work in accordance with the approved Contract Documents and executed Change Orders, including requirements reasonably inferable therefrom.

3.02 Skill and Judgment

The Contractor covenants with the University to furnish its best skill and judgment in furthering the interests of the University as defined in the Contract Documents. The Contractor shall perform all obligations under the Contract Documents using efficient business administration, superintendence and best efforts to facilitate the expeditious and timely completion of the Project consistent with the interests of the University as expressed in the Contract Documents. The Contractor acknowledges that significant effort will be invested in complying with the Contractor's Construction Schedule, and in maintaining construction quality. Accordingly, the Contractor further acknowledges that the greatest degree of professionalism is expected from the Contractor and the Design Professional in accomplishing their respective contractual obligations and that when potential conflicts exists, each shall demonstrate appropriate respect, professionalism and cooperation with each other in resolving such conflicts.

3.03 Scheduling

The Contractor shall develop a Contractor's Construction Schedule that clearly indicates the interrelationship of activities and defines the critical path of the entire Project. The Contractor shall submit a preliminary Contractor's Construction Schedule, by the earlier of fifteen (15) days from either the Notice to Proceed or the execution of this Agreement. The Contractor shall provide iterative updates to the Contractor's Construction Schedule with each Application for Payment, but no less than monthly. Upon request by the University, the
Contractor shall prepare and submit a resource-loaded Contractor's Construction Schedule to the University and Design Professional for approval.

3.04 Construction

3.04.1 Subcontracts and Purchase Agreements

The Subcontracts shall be solely between the Contractor and the Subcontractors. Nothing in any Subcontract shall establish any contractual relationship between the University and any Subcontractor. However, the University is an intended third-party beneficiary of all Subcontracts, purchase orders and other agreements; the Contractor shall incorporate the obligations of the Contract Documents into its respective Subcontracts, supply agreements and purchase orders.

The Contractor will screen and pre-qualify, utilizing appropriate industry standards, potential Subcontractors for the Work keeping in mind the requirement to recruit and encourage Minority/Women Business Enterprise participation. The University shall have the right to review and approve all Subcontractors qualified or rejected for qualification by the Contractor. The Contractor shall notify the University of all Subcontractors to be used, and the Contractor shall remove any Subcontractor to which the University has an objection.

The Contractor shall obtain appropriate guarantees and warranties acceptable to the University from the Subcontractors, which shall be for the direct benefit of the University.

3.04.2 Construction Supervision

a) The Contractor shall establish sufficient on-site organization, staffing and support as well as clear lines of authority in order to expeditiously complete the Project in accordance with the Contract Documents, in every aspect, on a totally coordinated basis.

b) The Contractor shall maintain a competent full-time staff available at the site while Work is being performed to supervise, schedule and coordinate the performance of the Work of all Subcontractors in accordance with the University's objectives including cost, time for completion and quality of the Work. Contractor’s Staffing Plan is attached as Exhibit D to this Agreement. The Staffing Plan shall not be changed, except with the written consent of the University's Representative unless members of the Project Staff cease to be in the employ of the Contractor.

c) The Contractor shall notify the University of the dates, times and locations of conferences with Subcontractors and schedule and conduct regular progress meetings to be attended by all parties in interest including the University to discuss such matters as procedures, progress, job problems, scheduling, coordination, changes, and related matters.

d) The Contractor shall take, transcribe and promptly distribute to all parties, including the University, minutes of such progress meetings with the Subcontractors, weekly job meetings and monthly management meetings.

e) The Contractor shall maintain an on-site daily log of construction progress, problems and items of special interest. The Contractor shall provide digital photographic files and digital recording showing Project status or progress. Such logs, records, photographs and videos shall be immediately available to the University upon request.

f) The Contractor shall furnish monthly written progress reports on the Subcontractors’ work in a form acceptable to the University and assist the Design Professional and the University with periodic and final inspections of the Work. At all inspections preceding the final inspection, the Contractor shall furnish a detailed report to the University of observed discrepancies, deficiencies, and omissions in the Work.
performed by any Subcontractor.

g) The Contractor shall provide and maintain a correct layout of the structures and monitor the Work to verify that all lines and levels are adhered to by the Subcontractors. The Contractor shall immediately report in writing all discrepancies with respect to design details for prompt resolution by the Design Professional.

h) The Contractor shall submit any Request for Information (RFI) to the Design Professional and University only after attempting to determine if the requested clarification is contained in the Contract Documents; any RFI shall contain sufficient detail to allow a response within seven (7) calendar days of when the RFI is submitted. In no event shall the response to an RFI be considered delayed unless more than fourteen days have passed since the RFI was submitted.

i) The Contractor shall supervise and direct the Work using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract Documents or that which is reasonably inferable for the completion of the Project.

j) The Contractor shall supervise and direct the Work using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract Documents or that which is reasonably inferable for the completion of the Project.

k) The Contractor shall be responsible to the University for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons performing any portion of the Work related to a contract with the Contractor.

l) The Contractor shall supervise and direct the Work using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract Documents or that which is reasonably inferable for the completion of the Project.

3.04.2.1 Safety

The Contractor shall protect adjoining property and nearby buildings, roads, and other facilities and improvements from dust, dirt, debris and other nuisances arising out of Contractor's operations or storing practices. Dust shall be controlled by sprinkling, negative pressure exhausting or other effective methods acceptable to University. Fugitive dust from interior demolition shall be controlled by negative pressure exhausting. An erosion and sedimentation control program shall be initiated, which includes measures addressing erosion caused by wind and water and sediment in runoff from site. A regular watering program shall be initiated to adequately control the amount of fugitive dust.

The Contractor is knowledgeable of and understands that the University may intend to maintain occupancy of certain portions of the existing facility. The Contractor shall exercise precaution at all times for the protection of persons and their property. The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to: (1) employees on the Work and other persons who may be affected thereby; (2) the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's subcontractors or sub-subcontractors; and (3) other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction. The Contractor shall install adequate safety guards and protective devices for all equipment and machinery, whether used in the Work or permanently installed as part of the Project.
The Contractor shall also provide and adequately maintain all required means of egress, including but not limited to, proper temporary walks, roads, guards, railings, lights, and warning signs. The Contractor shall comply with all applicable laws relating to safety precautions. The Contractor shall establish, maintain and update a Project Specific Safety Program.

The Contractor shall designate a responsible member of the Contractor’s organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor’s superintendent unless otherwise designated by the Contractor in writing to the University and Design Professional.

The Contractor shall require each and every one of its subcontractors and Trade subcontractors to comply with all of the provisions of this section.

The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in the Contract.

### 3.04.2.2 Hazardous Condition

The University and/or the Design Professional may bring to the attention of the Contractor a possible hazardous situation in the field regarding the safety of personnel on the site. The Contractor shall be responsible for verifying that all local, state, and federal workplace safety guidelines are being observed. In no case shall this right to notify the Contractor absolve the Contractor of its responsibility for monitoring safety conditions. Such notification shall not imply that anyone other than the Contractor has assumed any responsibility for field safety operations.

Explosives shall not be used without first obtaining written permission from the University and then shall be used only with the utmost care and within the limitations set in the written permission and in accordance with prudence and safety standards required by law. Storage of explosives on the Project site or University is prohibited. Powder activated tools are not explosive for purposes of this Article; however, such tools shall only be used in conformance with State safety regulations.

The Contractor shall immediately make a report to the University’s Police Department and report in writing to the University’s Representative, within eight (8) hours, all accidents whatsoever arising out of, or in connection with, the performance of the Work, whether on or off the Site but on University property, which caused death, personal injury or property damage, giving full details and statements of witnesses. In addition, if death or serious injuries or serious damages are caused, the accident shall be reported immediately by telephone or messenger. If any claim is made by anyone against the Contractor or any subcontractor on account of any accident, the Contractor shall report promptly the facts in writing to the University's Representative, giving full details of the claim.

### 3.04.2.3 University's Right to Stop the Work

If the Contractor fails to correct work which is not in accordance with the requirements of the Contract Documents as required, or persistently fails to carry out work in accordance with the Contract Documents, the University Representative, by written order may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the University to stop the Work shall not give rise to a duty on the part of the University to exercise this right for the benefit of the Contractor or any other person or entity.
It is understood that while the Contractor is fully responsible for the safety of the Work, and for the methods of its execution, if the University deems that the Contractor is failing to provide safe conditions, the University may stop the Work under such conditions. However, this ability shall not create such duty on the University. Under no circumstance shall the Contractor be granted a time extension or Contract Sum increase for conditions resulting by a stop work order.

3.04.2.4 University’s Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a three (3) day period after receipt of written notice from the University to commence and continue correction of such default or neglect with diligence and promptness, the University may after such three (3) day period, without prejudice to other remedies the University may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Design Professional’s additional services and expenses made necessary by such default, neglect or failure. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the University.

3.04.3 Document Management

The Contractor shall maintain at the job site, on a current basis, all Project documents including plans, specifications, shop drawings, samples, submittal, purchase orders, Subcontracts, material specifications, and any other related documents, and revisions thereto, which arise out of or relate to the Project, this Agreement or the Work. Prior to final payment, copies of all such records shall be provided to the University.

The Contractor shall be responsible for reviewing, processing and paying applications by Subcontractors for progress and final payment. The University will compensate the Contractor monthly based on the requirements of Article 4.04, Application For Payment.

The Contractor shall prepare and submit to the University every three months a report of the total M/WBE participation in the Project to demonstrate compliance with Paragraph 3.04.6 together with a projection of M/WBE participation through Final Completion.

3.04.3.1 Review of Contract Documents and Field Conditions by Contractor

Execution of the Contract by the Contractor is a representation that the Contractor shall have thoroughly and carefully examined the site of the Work; investigated any and all conditions which can affect the Work or its cost, including but not limited to, availability of labor, materials, supplies, water, electrical power, roads, access to the site, University episodic and scheduled closures, uncertainties of weather, water tables, the character of equipment and facilities needed to perform the Work, and local conditions under which the Work is to be performed; and further, that the Contractor shall insure that the documents issued for bidding by Trade Contractors reflect the results of this investigation and are adequate to complete the Work. It is the responsibility of the Contractor to be familiar with the materials, equipment, or procedures to be used in the Work, or which in any other way could affect the completion of the Work. Any failure to properly familiarize themselves with the proposed Work shall not relieve the Contractor from the responsibility for completing the Work in accordance with the Contract Documents.

The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Project. Contract Documents are complementary, and what is required by one shall be as binding as if required by all. Performance by the Contractor shall be required to be consistent with the Contract Documents and the highest standard of care. In the case of an inconsistency between, or perceived omission or error in the Drawings, Specifications, or other Contract Documents which is not clarified by addendum or RFI, or should the Contractor be in doubt as to their exact meaning, the Contractor shall notify
the Design Professional and the University prior to performing any related Work. The University shall not be responsible for the Contractor’s misinterpretations of Drawings and Specifications and/or other Contract Documents.

The Contractor shall have a continuing duty to read, carefully study and compare the Contract Documents and product data with each other and with information furnished by the University, and shall at once report to the Design Professional and the University errors, inconsistencies, ambiguities and omissions before proceeding with the affected Work. The Contractor shall be liable to the University for damage resulting from errors, inconsistencies or omissions in the Contract Documents, relating to constructability if the Contractor recognized or should have recognized such error, inconsistency, ambiguity or omission and failed to report it to the Design Professional and the University. If the Contractor performs any construction activity which involves such error, inconsistency, ambiguity or omission in the Contract Documents relating to constructability, without such notice to the Design Professional and the University, the Contractor shall assume responsibility for such performance and shall bear all costs attributable for correction. If the Contractor submits authorized substitutes that cost in excess of the Contract Sum which cause coordination conflicts, the Contractor shall bear all costs attributable to correction.

The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the Design Professional prior to performing any affected Work.

The Contractor shall perform the Work in accordance with the Contract Documents.

3.04.4 Cash Flow Estimates and Cost Control

At the University's request, the Contractor shall prepare a Cash Flow Estimate indicating the anticipated schedule of payment application amounts within fifteen (15) days after the Contractor’s Bid has been accepted. The Cash Flow Estimate shall be revised periodically, at least every three months, unless significant deviations are expected or otherwise more frequently as requested by the University.

The Contractor shall review requests for changes with the University, and with the University's approval, obtain quotations from affected Subcontractors. Bulletins to Subcontractors shall define the scope of the change and require pricing using either lump sum, time and materials or cost of Work for all items of Work, including overhead and profit as may be defined in the Bid and this Agreement and shall include costs related to schedule delays, if applicable. Where both additions and deductions are involved, each should be calculated separately. Contractor shall be responsible for reviewing the pricing submitted by Subcontractors for accuracy, completeness, and reasonableness.

3.04.5 Minority/Women Business Enterprise Participation

The University makes a continuous effort to strongly encourage Minority Business Enterprise (MBE) and Women Business Enterprise (WBE) contractors and supplier to bid on and participate in University contracts. To the fullest extent permitted under federal and Michigan law, you are strongly encouraged to retain the services of WBE and MBE Subcontractors and suppliers of goods and services in connection with performance of this Contract. For purposes of this Contract, MBE is defined as a business entity in which 51% or minority individuals hold more of the voting shares and interest in the enterprise. The minority ownership of the enterprise shall have management and investment control of the company. WBE is defined as a business entity in which 51% or a woman or women hold more of the voting shares and interest in the enterprise. The female ownership of the enterprise shall have management and investment control of the company.
3.04.7 Time of Completion

The Contractor acknowledges that time is of the essence in performing and completing the Work on the Project. Accordingly, the Contractor shall comply with the activity and milestone completion dates as defined in the Contractor's Construction Schedule as mutually agreed by the Contractor, the University and the Design Professional. The Contractor shall provide, prepare and/or participate in developing schedules, submittals, shop drawings, construction schedules, close out documents, or other activities consistent with the conditions of the Contract Documents and as set forth below:

A. Substantial Completion: [ENTER COMPLETION DATE]

B. Punchlist Completion: [ENTER COMPLETION DATE]

C. Final Completion: [ENTER COMPLETION DATE]

3.04.8 Timely Completion

Contractor acknowledges that the University has scheduled use of the Project immediately following the Dates of Substantial Completion. In scheduling that use, the University may have signed contracts and otherwise made financial commitments relating to the use of the Project no later than the date of Substantial Completion. In the event that the Contractor fails to complete on or before the date for Substantial Completion, the Contractor shall be responsible to reimburse the University for all direct, indirect and administrative costs and expenses incurred in locating, coordinating and securing alternate sites, refunding deposits, and taking any other reasonable action as a consequence of the Contractor's failure to achieve Substantial Completion by the date stated in this Agreement.

The University shall be entitled to retain from the Contractor those damages incurred upon the Contractor's default of Substantial Completion, as provided above.

The Contractor further agrees to complete 100% of all punchlist items, documented on the Substantial Completion certificate, within forty-five (45) days of the date of Substantial Completion. Nothing in this Article 3.04.08 shall be construed as a limitation or waiver on such other rights as the University may have.

3.04.8.1 Substantial Completion

"Substantial Completion" shall mean the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the University can occupy or utilize the Work for its intended use. Substantial Completion shall only be determined as described in the Contract Documents.

3.04.8.2 Final Completion

“Final Completion” means the completion of all the Work in accordance with the Contract Documents and the acceptance thereof by the University. Completion of the Work includes (1) full performance of all Contract terms; (2) acceptance of the Work by University; (3) resolution of all outstanding Changes of Contract; (4) completion of all "punch-list" items; and (5) delivery of all Close-out Documents.

3.05 Contractor's Insurance

The Contractor shall not commence Work under this Contract until it has obtained all the insurance required by the Contract Documents and such insurance has been approved by the University; likewise, no subcontractor or subconsultant shall be allowed to commence Work until the insurance required has been
obtained. The Contractor shall, at its expense, purchase and maintain in full force and effect such insurance as will protect itself and the University from claims, such as for bodily injury, death, and property damage, which may arise out of or result from the Work required by the Contract Documents, whether such Work is done by the Contractor, by any subcontractor, by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable. The types of such insurance and any additional insurance requirements are specified herein with the amounts and limits set forth in the Supplementary General Conditions.

3.05.1 Policies and Coverage

The following policies and coverages shall be furnished by the Contractor promptly upon request by the University:

(1) Comprehensive or Commercial Form General Liability Insurance covering all Work done by or on behalf of the Contractor and providing insurance for bodily injury, personal injury, property damage, and Contractual liability. Except with respect to bodily injury and property damage included within the products and completed operations hazards, the aggregate limit shall apply separately to work required of the Contractor by these Contract Documents. This insurance shall include the contractual obligations assumed under the Contract Documents and specifically section 4.06.

(2) Business Automobile Liability Insurance on an “Occurrence” form covering owned, hired, leased, and non-owned automobiles used by or on behalf of the Contractor and providing insurance for bodily injury, property damage, and Contractual liability.

(3) Worker’s Compensation and Employer’s Liability Insurance as required by Federal and Michigan law. The Contractor shall also require all of its Subcontractors to maintain this insurance coverage.

(4) The Umbrella Excess Liability insurance must be consistent with and follow the form of the primary policies, except that Umbrella Excess Liability insurance shall not be required for the Medical Expense Limit.

(5) Builder’s Risk Insurance.

(6) Professional Liability Insurance (Errors and Omissions).

3.05.2 Proof of Coverage

Certificates of Insurance, or other evidence of the insurance required by these Contract Documents or requested by the University, shall be submitted by the Contractor to the University. The Certificates of Insurance shall state the scope of coverage and deductible, identify any endorsements to the policies and list the University as an additional named insured. Any deductible shall be the Contractor’s liability. The Certificates of Insurance shall provide for no cancellation or modification of coverage without thirty (30) days prior written notice to the University. Acceptance of Certificates of Insurance by the University shall not in any way limit the Contractor’s liabilities under the Contract Documents. In the event the Contractor does not comply with these insurance requirements, the University may, at its option, provide insurance coverage to protect the University; the cost of such insurance shall be deducted from the Contract Sum or otherwise paid by the Contractor. Renewal certifications shall be filed in a timely manner for all coverage until the Project is accepted as complete. Upon the University’s request, the Contractor shall provide copies of the policies obtained from the insurers.

3.05.3 Subcontractor’s Insurance

The Contractor shall either require subcontractors to carry the insurance or the Contractor shall insure the activities of the subcontractors in the amount, types and form of insurance required by the Contract
Documents. If the Contractor elects to have its subcontractors purchase individual insurance policies, the Contractor's subcontracts shall include a clause requiring that copies of any insurance policies which provide coverage to the Work shall be furnished to the University. The Contractor shall supply the University with a list of all subcontractors showing whether or not they have individual insurance policies and certifying that those subcontractors without individual insurance policies are insured by the Contractor.

3.05.4 Scope of Insurance Coverage

The Contractor's insurance as required by the Contract Documents (including subcontractors' insurance), by endorsement to the policies and the Certificates of Insurance, shall include the following and may be presented in the form of a rider attached to the Certificates of Insurance:

(1) The Board of Governors of Wayne State University, the University, their officers, employees, representatives and agents including the Design Professional, shall be included as additional named insureds for and relating to the Work to be performed by the Contractor and subcontractors. This shall apply to all claims, costs, injuries, or damages.

(2) A Severability of Interest Clause stating that, "The term ‘insured’ is hereby used severally and not collectively, but the inclusion herein of more than one insured shall not operate to increase the limits of the insurer's or insurers' liability."

(3) A Cross Liability Clause stating that, "In the event of claims being made under any of the coverages of the policy or policies referred to herein by one or more insured hereunder for which another or other insured hereunder may be liable, then the policy or policies shall cover such insured or insured against whom a claim is made or may be made in the same manner as if separate policies had been issued to each insured hereunder. Nothing contained herein, however, shall operate to increase the insurer’s limits of liability as set forth in the insuring agreements."

(4) The Board of Governors of Wayne State University, the University, their officers, employees, representatives and agents, shall not by reason of their inclusion as insured incur liability to the insurance carriers for payment of premiums for such insurance. However, the Board of Governors of Wayne State University may, in their sole discretion after receiving a notice of cancellation for nonpayment, elect to pay the premium due and deduct such payment from any sums due to the Contractor or recover the amount paid from the Contractor if the sums remaining are insufficient.

(5) Coverage provided is primary and is not in excess of or contributing with any insurance or self-insurance maintained by the Board of Governors of Wayne State University, the University, their officers, employees, representatives and agents.

3.05.5 Miscellaneous Insurance Provisions

The form and substance of all insurance policies required to be obtained by the Contractor shall be subject to approval by the University. All such policies shall be issued by companies lawfully authorized to do business in Michigan and be acceptable to the University. All property insurance policies to be obtained by the Contractor shall name the University as loss payee as its interest, from time to time, may appear.

The Contractor shall, by mutual agreement with the University and at the University's cost, furnish any additional insurance as may be required by the University. The Contractor shall provide appropriate endorsements evidencing such additional insurance.

In the event that the scope of Work includes asbestos abatement, the Contractor or subcontractor, as appropriate, shall provide $1,000,000 asbestos liability insurance.
The University is not required to provide or purchase any additional insurance with respect to this Project or the Work required of the Contractor for the Project.

3.05.6 Loss Adjustment

Any insured loss is to be adjusted with the University and made payable jointly to the University and the Contractor. The Contractor shall cooperate with the University in a determination of the actual cash value or replacement value of any insured loss. Any deductible amount shall be the responsibility of the Contractor to resolve.

3.05.7 Compensation Distribution

The University upon the occurrence of an insured loss shall account for any money so received and shall distribute it in accordance with such agreement as the interested parties may reach. Claim payments received shall be distributed proportionately according to the actual percentages of losses to both. If after such loss no other special agreement is made, replacement of damaged work shall be covered by an appropriate contract change order. Any dispute shall be resolved by the University.

3.05.8 No Waiver of Subrogation

The University does not waive any rights of Subrogation that it may possess on this Project.

3.06 Indemnification

3.06.1

To the fullest extent permitted by law, the Contractor shall hold harmless, defend, and indemnify the Board of Governors of Wayne State University, the University, and officers, employees, representatives and agents of each of them, from and against any and all claims or losses arising out of or are alleged to be resulting from, or relating to (1) the failure of the Contractor to perform its obligations under the Contract or the performance of its obligation in a willful or negligent manner; (2) the inaccuracy of any representation or warranty by the Contractor given in accordance with or contained in the Contract Documents; and (3) any claim of damage or loss by any subcontractor, or supplier, or laborer against the University arising out of any alleged act or omission of the Contractor or any other subcontractor, or anyone directly or indirectly employed by the Contractor or any subcontractor.

3.06.2

To the fullest extent permitted by law, the Contractor shall be liable for and hereby agrees to defend, discharge, fully indemnify and hold the University harmless from and against any and all claims, demands, damages, liability, actions, causes of action, losses, judgments, costs and expenses of every nature (including investigation costs and/or expenses, settlement costs, and attorney fees and expenses incident thereto) sustained by or asserted against the University arising out of, resulting from, or attributable to the performance or nonperformance of any Work and/or obligation covered by the Contract or to be undertaken in connection with the construction of the Project contemplated by the Contract (collectively, "Claim"), including, but not limited to, any Claim for: (a) any personal or bodily injury, illness or disease, including death at any time resulting therefrom of any person, (including, but not limited to, employees of the University, the Contractor, any subcontractor, and any materialman and the general public); (b) any loss, damage or destruction of any property; (c) any loss or damage to the University’s operations, arising out of, resulting from, or attributable in whole or in part to (i) any negligence or other act or omission of the Contractor, and any subcontractor, any materialman and/or any other person or any of the directors, officers, employees or agents of any of them or (ii) any defects in material or equipment furnished hereunder; (d) any payments allegedly owed to subcontractors, sub-subcontractors or materialmen; (e) any acts or omissions relative to conditions of safety
and protection of persons on the Project site; and/or (f) any act or omission relative to the Contractor's breach of obligations and regarding non-discrimination as set forth in these General Conditions. The Contractor shall not be liable hereunder to indemnify the University against liability for damages arising out of bodily injury to persons or damage to property caused by or resulting from the sole negligence or willful misconduct of the University, its agents or employees. The Contractor, at its own cost and expense, shall take out and maintain at all times during the effective period of the Contract, contractual liability insurance insuring the performance by the Contractor of its contractual duties and obligations under this Article, which insurance shall name the University as additional insured and shall be in form and amount and from an insurance company satisfactory to the University. The Contractor's duty to fully indemnify the University shall not be limited in any way by the existence of this insurance coverage.

3.06.3
The Contractor shall also be liable for and hereby agrees to pay, reimburse, fully indemnify and hold the University harmless from and against all costs and expenses of every nature (including attorney fees and expenses incident thereto) incurred by the University in collecting the amounts due from the Contractor, or otherwise enforcing its rights, under the indemnifications described in this Article.

3.06.4
In claims against any person or entity indemnified under this Article made by an employee of the Contractor or a Subcontractor, supplier or indirectly employed by any of them, or anyone for whose acts is made liable, the indemnification obligation under this Article shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor, Subcontractor or supplier under workers compensation laws, disability benefit laws, or other laws providing employee benefits.

3.06.5
The indemnification obligations under this Article shall not be limited by any assertion or finding that the person or entity indemnified is liable by reason of a non-delegable duty.

3.06.6
The Contractor shall hold harmless, defend, and indemnify the University from and against losses resulting from any claim of damage made by any separate contractor of the University against the University arising out of any alleged acts or omissions of the Contractor, a subcontractor, anyone directly or indirectly employed by either the Contractor or subcontractor, or anyone for whose acts either the Contractor or subcontractor may be liable.

3.06.7
The Contractor shall hold harmless, defend, and indemnify the separate Contractors of the University from and against losses arising out of the negligent acts or omissions or willful misconduct of the Contractor, a subcontractor, anyone directly or indirectly employed by the Contractor or subcontractor, or anyone for whose acts the Contractor or subcontractor may be liable.

3.07 Guarantee
The Contractor unconditionally guarantees the Work under this Contract to be in conformance with the Contract Documents and to be and remain free of defects in workmanship and materials not inherent in the quality required or permitted. Contractor shall repair or replace any Work, together with any adjacent Work which may be displaced in so doing, which is not in accordance with the requirements of the Contract or which is defective in its workmanship or material, all without any expense whatsoever to the University for a period of
one (1) year / two (2) years from the date of Substantial Completion, unless a longer guarantee period is stipulated in the Contract Documents or otherwise available from the manufacturer ("Repair Period").

Special guarantees that are required by the Contract Documents shall be signed by the Contractor who is responsible for the entire work and countersigned by the subcontractor who performs the work.

The Contractor further agrees that within five calendar days after being notified in writing by the University of any Work not in accordance with the requirements of the Contract Documents or of any defects in the Work, it shall commence and prosecute with due diligence all Work necessary to fulfill the terms of this guarantee and to complete the Work in accordance with the requirements of the Contract with sufficient manpower and material to complete the repairs as expeditiously as possible. The Contractor, in the event of failure to so comply, does hereby authorize the University to proceed to have the Work done at the Contractor's expense, and it agrees to pay the cost thereof upon demand. The University shall be entitled to all costs necessarily incurred upon the Contractor's refusal to pay the above cost.

Notwithstanding the foregoing paragraph, in the event of an emergency constituting an immediate hazard to health, safety or damage of the University's employees, property, or licenses, the University may undertake at the Contractor's expense, without prior notice, all Work necessary to correct such hazardous conditions caused by the Work of the Contractor not being in accordance with the requirements of this Contract.

The Contractor shall require a similar guarantee in all subcontracts, including the requirement that the University be reimbursed for any damage or loss to the Work or to other Work resulting from such defects.

If required by the Contract Documents, the Maintenance and Guarantee Bond shall be in full force and effect during the entire Repair Period, unless a longer bond period is stipulated in the Contract Documents.

4.00 CONTRACTOR'S COMPENSATION

4.01 Basis of Compensation

In consideration of the full performance of this Agreement by the Contractor, the University shall compensate the Contractor as stated in Exhibit B.

4.02 Change Orders and Construction Change Directives

4.02.1 Generally

The University reserves the right to issue written orders whether through a formal Change Order or Construction Change Directive, directing changes in the Contract at any time prior to the acceptance of the Project without voiding the Contract, and Contractor shall promptly comply with such order. A Construction Change Directive may be issued in writing by the University directing the Contractor to perform changed Work in the absence of a final agreement on a Change Order and the costs will be calculated as provided in 6.01.4. The Contractor may request changes in the Work, but shall not act on the changes until approved in writing by the University. Any change made without authority in writing from the University shall be the responsibility of the Contractor.

Any such changes in the Work that have a cost impact shall only be authorized by Change Orders approved by the University. No action, conduct, omission, prior failure or course of dealing by the University shall act to waive, modify, change or alter the requirement that Change Orders must be in writing and signed by the University and Contractor and that such written Change Orders are the exclusive method for changing or altering the Contract Sum or Contract Time. The University and Contractor understand and agree that the Contract Sum and Contract Time cannot be changed by implication, oral agreements, actions, inaction, course of conduct or Construction Change Directive.
On the basis set forth herein, the Contract Sum may be adjusted for any Change Order requiring a different quantity or quality of labor, materials or equipment from that originally required, and the partial payments to the Contractor, set forth in section 8.01, may be adjusted to reflect the change. Whenever the necessity for a change arises, the Contractor shall take all necessary steps to mitigate the effect of the ultimate change on the other Work in the area of the change. Changed Work shall be performed in accordance with the original Contract requirements except as modified by the Change Order. Except as herein provided, the Contractor shall have no claim for any other compensation including lost productivity or increased overhead expenses due to changes in the Work. The amounts set forth in the Change Order constitute full compensation for both direct and indirect costs of the Work described in the Change Order. Payment by the University pursuant to the Change Order shall constitute full satisfaction of any and all claims for compensation and extension of time by the Contractor for the performance of the Work by the Contractor and all subcontractors.

4.02.2 Proposed Change Orders

The Design Professional, with approval of the University, shall issue to the Contractor a cost request Bulletin for a proposed change order describing the intended change and shall require the Contractor to indicate thereon a proposed amount to be added to or subtracted from the Contract Sum due to the change supported by a detailed estimate of cost. Upon request by the University, the Contractor shall permit inspection of the original Contract estimate, subcontract agreements, or purchase orders relating to the change. Any request for adjustment in Contract Time which is directly attributable to the changed Work shall be included with substantiating detailed explanation by the Contractor in its response to the cost request bulletin. Failure by Contractor to request adjustment of Contract Time in the response to the cost request Bulletin shall waive any right to subsequently claim an adjustment of the Contract Time based on the changed Work. The Contractor shall submit the response to the cost request Bulletin with detailed estimates and any time extension request thereon to the Design Professional and the University’s Representative within ten (10) calendar days after issuance of the cost request bulletin. Upon its submission the Design Professional will review it and advise the University who will make the decision. If the Contractor fails to submit the response within the required ten (10) calendar days, and the Contractor has not obtained the Design Professional’s and the University’s permission for a delay in submission, the University may order the Contractor in writing to begin the Work immediately, and the Contract Sum shall be adjusted in accordance with the University’s estimate of cost. In that event, the Contractor, within fifteen days following completion of the changed Work, may present information to the University that the University’s estimate was in error; the University, in its sole discretion, may adjust the Contract Sum. The Contractor must keep and submit to the University time and materials records verified by the University to substantiate its costs. The University may require the Contractor to proceed immediately with the changed Work in accordance with section 4.02.4, “Failure to Agree as to Cost” or section 4.02.6 “Emergency Changes.”

When the University and the Contractor agree on the amount to be added to or deducted from the Contract Sum and the time to be added to or deducted from the Contract Time and an Impact Report or a Contract Change Order is signed by the University and the Contractor, the Contractor shall proceed with the changed Work. If agreement is reached as to the adjustment in compensation for the performance of changed Work but agreement is not reached as to the time adjustment for such Work, the Contractor shall proceed with the Work at the agreed price, reserving the right to further pursue its Claim for a time adjustment. Any costs incurred to acquire information relative to a proposed Change Order shall not be borne by the University.

4.02.3 Allowable Costs Upon Change Orders

The only estimated or actual costs that will be allowed because of changed Work and the manner in which those costs shall be computed is described by this section.

4.02.3.1 Labor
Costs are allowed for the actual payroll cost to the Contractor for direct labor, engineering or technical services directly required for the performance of the changed Work, (but not site management such as field office estimating, clerical, project engineering, management or supervision) including payments, assessments, or benefits required by lawful labor union collective bargaining agreements, compensation insurance payments, contributions made to the State pursuant to the Unemployment Insurance Code, and for taxes paid to the federal government required by the Social Security Act of August 14, 1935, as amended, unless the time of completion adjustments affect the general condition inclusion of the Contract Sum.

No labor cost will be recognized at a rate in excess of the appropriate wage rates established for that portion of the Work, nor will the use of a classification which would increase the labor cost be permitted unless the Contractor established to the satisfaction of the University the necessity for payment at a higher rate.

4.02.3.2 Materials

Costs are allowed for the actual cost to the Contractor for the materials directly required for the performance of the changed Work. Such cost of materials may include the costs of transportation, sales tax, and delivery if necessarily incurred. However, overhead costs shall not be included. If a trade discount by the actual supplier is available to the Contractor, it shall be credited to the University. If the materials are obtained from a supply or source owned wholly or in part by the Contractor, payment therefor will not exceed the current wholesale price for such materials.

If, in the opinion of the University, the cost of materials is excessive, or if the Contractor fails to furnish satisfactory evidence of the cost from the actual suppliers thereof, then in either case the cost of the materials shall be deemed to be the lowest wholesale price at which similar materials are available in the quantities required at the time they were needed.

4.02.3.3 Equipment

Costs are allowed for the actual cost to the Contractor for the use of equipment directly required in the performance of the changed Work except that no payment will be made for time while equipment is inoperative due to breakdowns or for non-working days. The rental time shall include the time required to move the equipment to the Project site from the nearest available source for rental of such equipment, and to return it to the source. If such equipment is not moved by its own power, then loading and transportation costs will be paid. However, neither moving time nor loading and transportation costs will be paid if the equipment is used on the Project in any other way than upon the changed Work. Individual pieces of equipment having a replacement value of $500.00 or less shall be considered to be tools or small equipment, and no payment therefor will be made.

For equipment owned or furnished by the Contractor, no cost therefor shall be recognized in excess of the rental rates established by distributors or equipment rental agencies in the locality where the Work is performed. Blue Book rates shall not be used for any purpose.

The amount to be paid to the Contractor for the use of equipment as set forth above shall constitute full compensation to the Contractor for the cost of fuel, power, oil, lubrication, supplies, small tools, small equipment, necessary attachments, repairs and maintenance of any kind, depreciation, storage, insurance, labor (except for equipment operators who shall be paid for as provided in Article 4.02.3.1) and any and all costs to the Contractor incidental to the use of such equipment.

4.02.3.4 Work by Subcontractors and Vendors

For any portion of the changed Work which is to be performed by a subcontractor, the Contractor shall furnish to the University a detailed estimate prepared and signed by subcontractor of the cost to subcontractor for performing the changed Work. At the sole discretion of the University, a lump sum estimate of such cost to
subcontractor may be accepted in lieu of the detailed estimate. The combined costs for subcontractor's overhead, profit, taxes, indirect supervision, insurance, bonds shall not exceed ten percent (10%). Estimates of the amount to be deleted from subcontractor's portion of the Work shall be gross cost of the deducted Work plus eight percent (8%). For changed Work to be furnished by a supplier, the Contractor shall furnish upon demand of the University, a lump sum estimate of the cost of the items including taxes and cartage to the Contractor prepared by the supplier. No supplier mark-up for overhead, profit, layout, supervision or bonds will be allowed for changed Work furnished by a supplier.

4.02.3.5 Contractor Mark-up for Added Work

Where changed Work is performed, the Contractor may add to the total estimated actual cost for such Work no more than ten (10%) for subcontractor mark-up and seven and one-half percent (7.5%) for self-performed trade work for profit, overhead, insurance, taxes, indirect supervision, bonds, and any other costs not allowed by section 4.02.01.

4.02.3.6 Credit for Deleted Work

The amount to be deducted from the Contract Sum shall be the total estimated actual cost of the deducted Work plus eight percent (8%).

Where an entire item or section of Work is deleted from the Contract, the entire subcontract cost or bid cost shall be considered the appropriate deduction less the value of Work performed. If the subcontract cost or bid cost is not identifiable, then estimates of the amount to be deducted from the Contract Sum shall be the gross cost of the deducted work plus six percent (6%) for saved overhead, bonds, insurance, and taxes.

For proposed change orders which involve both added and deleted Work, the Contractor shall separately estimate the cost of the added Work before mark-ups, and separately estimate the cost of the deleted Work before allowance of a credit. If the difference between the costs results in an increase to the Contract Sum, the mark-up for added Work shall be applied to the difference, and if the difference in the costs results in a decrease, then the mark-up for deleted Work shall be applied to the difference.

4.02.3.7 Market Values

Cost for added Work shall be no more than market values prevailing at the time of the change, unless the Contractor can establish to the satisfaction of the University that it investigated all possible means of obtaining Work at prevailing market values and that the excess cost could not be avoided.

When a change order deletes Work from the Contract, the computation of the cost thereof shall be the values which prevailed at the time bids for the Work were opened or the Contract Sum established.

4.02.4 Failure to Agree as to Cost

4.02.4.1 For Added Work

Notwithstanding the failure of the University and the Contractor to agree as to the cost of the proposed Change Order, the Contractor, upon written order from the University, shall proceed immediately with the changed Work. A Construction Change Directive or letter signed by the University shall be used for this written order. At the start of each day’s Work on the change, the Contractor shall notify the University in writing as to the size of the labor force to be used for the changed Work and its location. Failure to so notify may result in the non-acceptance of the costs for that day. At the completion of each day’s Work, the Contractor shall furnish to the University a detailed summary of all labor, materials, and equipment employed in the changed Work. The University will compare his/her records with Contractor’s daily summary and may make any necessary adjustments to the summary. After the University and the Contractor agree upon and
sign the daily summary, the summary shall become the basis for determining costs for the additional Work. The sum of these costs when added to an appropriate mark-up will constitute the payment for the changed Work. Subsequent adjustments, however, may be made based on later audits by the University. When changed Work is performed at locations away from the job site, the Contractor shall furnish in lieu of the daily summary, a summary submitted at the completion of the Work containing a detailed statement of labor, material, and equipment used in the Work. This latter summary shall be signed by the Contractor who shall certify thereon that the information is true.

The Contractor shall maintain and furnish on demand of the University itemized statements of cost from all vendors and subcontractors who perform changed Work or furnish materials and equipment for such Work. All statements must be signed by the vendors and the subcontractors.

4.02.4.2 For Deleted Work

When a proposed Change Order contains a deletion of any Work, and the University and the Contractor are unable to agree upon the cost thereof, the University's estimate shall be deducted from the Contract Sum and may be withheld from any payment due the Contractor until the Contractor presents adequate substantial information to the University that the University's estimate was in error. The amount to be deducted shall be the actual costs to the Contractor for labor, materials, and equipment which would have been used on the deleted Work together with an amount for mark-up as defined in the Contract Documents.

4.02.5 Allowable Time Extensions

For any change in the Work, the Contractor shall only be entitled to such adjustments in Contract Time due solely to performance of the changed Work. The procedure for obtaining an extension of time is set forth in Section 4.08 of these General Conditions. No extension of time shall be granted for a change in the Work unless the Contractor demonstrates to the satisfaction of the University that the Work is on the critical path and submits an updated CPM schedule showing that an extension of time is required and that the Contractor is making, or has made, every reasonable effort to guarantee completion of the additional Work called for by the change within the time originally allotted for the Contract. Failure by the Contractor to make the required submission or showing constitutes a waiver of any possible adjustment in Contract Time.

Any adjustment in Contract time shall specify the exact calendar day.

4.02.6 Emergency Changes

Changes in the Work made necessary due to unforeseen site conditions, discovery of errors in plans or specifications requiring immediate clarification in order to avoid a serious Work stoppage, changes of a kind where the extent cannot be determined until completed, or under any circumstances whatsoever when deemed necessary by the University are kinds of emergency changes which may be authorized by the University in writing to the Contractor. The Contractor shall commence performance of the emergency change immediately upon receipt of written direction from the University.

If agreement is reached as to compensation adjustment for the purpose of any emergency change, then compensation will be as provided in this section relating to ordinary changes. If agreement is not reached as to compensation at the time of commencing the emergency change, then compensation will be as provided in section 4.02.4, that is, time and materials records and summaries shall be witnessed and maintained until either a lump sum payment is agreed upon, or the changed Work is completed.

4.03 Records and Audit

4.03.1
Contractor’s records, which shall include but not be limited to accounting records (hard copy, as well as computer readable data if it can be made available), written policies and procedures; subcontract files (including proposals of successful and unsuccessful bidders, bid recaps, etc.); original estimates; estimating work sheets, correspondence; change order files (including documentation covering negotiated settlements); backcharge logs and supporting documentation; general ledger entries detailing cash and trade discounts earned, insurance rebates and dividends; and any other supporting evidence deemed necessary by the University to substantiate changes related to the Agreement (collectively referred to as "Records") shall be maintained in accordance with Generally Accepted Accounting Principles and open to inspection and subject to audit and/or reproduction by University's agent or its authorized representative to the extent necessary to adequately permit evaluation and verification of Cost of the Work, and any invoices, change order, payments or claims submitted by the Contractor or any of his payees pursuant to the execution of the contract.

4.03.2

Such audits may require inspection and copying from time to time and at reasonable times and places of any and all information, materials and data of every kind and character, including without limitation, records, books, papers, documents, subscriptions, recordings, agreements, purchase order, leases, contracts, commitments, arrangements, notes, daily diaries, superintendent reports, drawings, receipts, vouchers and memoranda, and any and all other agreements, sources of information and matters that may in University's judgment have any bearing on or pertain to any matters, rights, duties or obligations under or covered by any Contract Documents. Such records subject to audit shall also include, but not be limited to, those records necessary to evaluate and verify direct and indirect costs, (including overhead allocations) as they may apply to costs associated with this Agreement.

4.03.3

The University or its designee shall be afforded access to all of the Contractor's Records, and shall be allowed to interview any of the Contractor's employees, pursuant to the provisions of this article throughout the term of this contract and for a period of six (6) years after Final Payment or longer if required by law. To the extent University deems is allowed by law, the Contractor's records shall remain confidential. Contractor recognizes and agrees that University will disclose documents it deems is required or appropriate pursuant to law, defense against lawsuits or other claims, or other reason deemed necessary by University.

4.03.4

Contractor shall require all Subcontractors, insurance agents, and material suppliers (payees) to comply with the provisions of this article by insertion of the requirements hereof in a written contract agreement between Contractor and payee. Such requirements will also apply to Subcontractors and all lower tier Subcontractors. Contractor will cooperate fully and will cause all of Contractor's Subcontractors (including those entering into lump sum contracts, payees or lower tier Subcontractors) to cooperate fully by furnishing or making available to University from time to time whenever requested in an expeditious manner any and all such information, materials and data.

4.03.5

University's agent or its authorized representative shall have access to the Contractor's facilities, shall have access to all records deemed necessary by University; and shall be provided adequate and appropriate work space, in order to conduct review or audits in compliance with this article.
Contractor agrees that University's designee shall have the right to examine the Contractor's records 
during the contract period and up to six(6) years after Final Payment is made on the contract) to verify the 
accuracy and appropriateness of the pricing data used to price change proposals or claims. Contractor 
agrees that if the University determines the cost and pricing data submitted (whether approved or not) was 
inaccurate, incomplete, not current or not in compliance with the terms of the contract regarding pricing of 
change orders, an appropriate contract price reduction shall be made. Such post-approval contract price 
adjustments will apply to all levels of Contractors and/or Subcontractors and to all types of change order 
proposals specifically including lump sum change orders, unit price change orders and cost-plus change 
orders.

4.03.7

If an audit, inspection or examination in accordance with this article, discloses overcharges (of any nature) 
by the Contractor to the University in excess of one percent (1%) of the total contract billings, the actual 
cost of the University's audit shall be reimbursed to the University by the Contractor. Any adjustments 
and/or payments which must be made as a result of any such audit or inspection of the Contractor's 
invoices and/or records shall be made within a reasonable amount of time (not to exceed 90 days) from 
presentation of University's findings to Contractor.

4.03.8

If this Agreement is determined to be subject to Section 1861(v)(1)(I) of the Social Security Act, as 
amended from time to time, the Contractor agrees that for a period of four (4) years following the 
expiration or earlier termination of this Agreement, the Contractor shall retain and make available to the 
Secretary of Health and Human Services, the Comptroller General of the United States, or any of their 
duly authorized representatives, this Agreement, and any books, documents, and records of the 
Contractor which are necessary to certify the nature and extent of amounts paid by the University pursuant 
to this Agreement. In the event access to books, documents, and records is requested by the Secretary, 
the Comptroller General, or any of their duly authorized representatives, the Contractor shall immediately 
notify the University and make such books, documents and records available to the University unless 
prohibited by law.

4.04 Applications for Payment

The Contractor shall prepare and deliver to the University monthly an itemized Application for Payment. The 
University shall pay the Contractor within thirty (30) days of receipt of a properly submitted, complete and 
correct Application for Payment. The Applications for Payment shall include a Schedule of Values describing 
the services included and Work completed in the Application for Payment. No interest shall accrue on any 
unpaid portion of the Applications for Payment or any other sums that the Contractor or any Subcontractor or 
supplier claim are or may be due under this Agreement.

The Application for Payment shall constitute a representation by the Contractor to the University that the Work 
has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, 
and the Contractor is entitled to payment. No progress payment, partial use or entire use of the Project by the 
University shall constitute acceptance of work not in strict conformity with the Contract Documents.

The Contractor shall keep records of cost and expense to support the Contractor's Applications for Payment, 
including without limitation records of staff time, material costs, and reimbursable expense items in 
connection with the Work. Financial records shall be kept on a generally recognized accounting basis, as 
approved by the University. Contractor shall make them readily available to the University or its 
representatives for inspection and audit for a period of six (6) years after the Project Close-out and Final 
Payment to the Contractor.
The Application for Payment shall be accompanied by a Sworn Statement completed by the Contractor, together with Certified Payrolls prepared in accordance with Section 5.02, as well as other documentation that may be required by the University, stating that all Subcontractors and suppliers have been paid in full for Work performed through the last or most recent progress payment.

4.05 Retainage

Payments to the Contractor shall be subject to retainage of ten percent (10%) of the Cost of Work for each Application for Payment until the Work is fifty percent (50%) complete; at that time, no further retainage will be deducted from the Applications for Payment. Draws on retainage may only be submitted after Substantial Completion and in the following quantities: (1) at the completion of all Punchlist items, the retainage may be reduced to two percent (2%); and (2) at delivery of all Closeout Documents and warranties, the remainder of the retainage may be paid to the Contractor. Any release of retainage shall be at the sole discretion of the University.

4.06 Final Payment

Issuance of Final Payment shall be expressly conditioned on certification of Substantial Completion, certification of Punchlist completion and written acceptance of closeout documents by the Design Professional and University.

5.00 PREVAILING WAGES

5.01 Applicable Wage Rates

The Contractor acknowledges and shall abide by the University's prohibition on use of 1099 independent contractors and owner / operator business entities wherein such individuals or entities are not able to secure and maintain workers compensation insurance. The Contractor shall ensure that all classifications of laborers and construction mechanics performing Work on the Project job site are employees of the Contractor or any subcontractor for any tier thereof, and that each worker is covered by workers compensation insurance.

For this project, it is a University requirement that the Contractor and all Subcontractors and sub-subcontractors who provide labor on this project shall compensate each worker, regardless of their employment status, not less than the wage and fringe benefit rates prevailing in the locality in which the work is to be performed. At the time of advertising for bids on the project, the University shall provide the prevailing rates of wages and fringe benefits for all classes of construction mechanics called for in the Contract. A schedule of these rates shall be made a part of the specifications for the work to be performed and shall be printed on the bidding forms where the work is to be done by contract. Contractor shall also post on site, in a conspicuous place, a copy of all applicable wage and benefit rates, and shall provide the University with a copy of the applicable wage and benefit rates posted.

5.02 Certified Payroll Records and Supporting Documents

The Contractor and each Subcontractor shall keep an accurate record showing the name and occupation of and the actual benefits and wages paid to each laborer and mechanic working in connection with this contract and shall be submitted with each pay application in accordance with Section 4.04. Contractor shall be required to 1) collect all certified payroll records from Contractor and Subcontractors and sub-subcontractors; 2) provide and require Subcontractors and sub-subcontractors to provide the University access to supporting documentation, and 3) shall provide this information, records, and/or access to documentation to the University or its agent(s) or auditors for review or audit promptly on request. Contractor shall, and shall also require all subcontractors and sub-subcontractors to, promptly provide information relating to payroll and job classification and work duties to University upon request. 
University reserves the right to audit Contractor, Subcontractors, and sub-subcontractors for compliance with wage and hour requirements, prevailing wage, employee classifications and other applicable requirements.

5.02.1 Audit

In connection with the prevailing wage rate audit conducted by the University, the Contractor is required to maintain and/or promptly obtain the following information, records and documentation from Contractor, all Subcontractors, and all sub-subcontractors and to promptly provide them to the University upon request:

1. Canceled payroll checks
2. Pay stubs
3. Weekly time cards on time sheets
4. Payroll registers
5. Employee handbook
6. Fringe benefit plan documents
7. Minutes of Board of Directors meetings
8. Worksheets for calculation of non-cash fringe benefit amounts included in compensation
9. Apprentice certificates and other documents to verify registration of all apprentices in recognized apprentice program certified by the Bureau of Apprenticeship and Training (B.A.T.) of the U.S. Dept. of Labor or an acceptable equivalent
10. Other related documents as requested by the University.

5.02.2 Failure to Comply with Audit

If the requested information and/or records are not promptly provided pursuant to University’s request, in addition to all other rights and remedies it has pursuant to law, equity and contract, the University, by written notice to Contractor and the sureties of the contractor known to the University may, but has no obligation or duty to, 1) terminate the contract with Contractor and University owe Contractor and be liable only for that prorated portion of satisfactorily completed work up to the date of termination; 2) withhold further payments owed until Contractor supplies the requested information and records and/or otherwise complies with the request for records and/or access to documentation; and 3) inform the Vice-President for Finance and Business Operations of what has been requested and what has not been provided by Contractor and/or subcontractor or sub-subcontractor. Contractor is hereby given express notice that failure to comply with University’s requests for information and records may disqualify Contractor and/or non-complying Subcontractors/sub-subcontractors from bidding and/or receiving work on future University projects. The University may proceed to complete this contract by separate agreement with another contractor or otherwise and the original Contractor and its sureties shall be liable to the University for any excess cost occasioned thereby.

5.03 Classification of Workers

All apprentices utilized on this University project must be registered in a recognized apprentice program, i.e., one that is certified by the Bureau of Apprenticeship (B.A.T.), U.S. Department of Labor. The workers used on a University project by either Contractor or a Subcontractor must be employees of the Contractor or Subcontractor and not individuals claimed as subcontractors or independent contractors, such as individuals whose compensation is reflected on IRS form 1099. The use of individuals as independent contractors is prohibited without express written permission of the University.

5.04 Failure to Pay
If a Contractor or subcontractor fails to pay the prevailing rates of wages and fringe benefits and does not cure such failure within fourteen (14) days after notice to do so by the University, the University shall have the right, at its option, to do any or all of the following:

5.04.1

Withhold all or any portion of payments due the Contractor as may be considered necessary by the University to pay laborers and mechanics the difference between the rates of wages and fringe benefits required by this Agreement and the actual wage and fringe benefits paid.

5.04.2

Terminate part or all of this Agreement or any subcontract and proceed to complete the Agreement or subcontract by separate agreement with another contractor or otherwise, in which case the Contractor and its sureties shall be liable to the University for any excess costs incurred by the University.

5.04.3 University’s Rights Cumulative

It is expressly understood by both parties that the above are in addition to University’s other rights and remedies, and University retains all other rights and remedies it has pursuant to this Agreement, or otherwise, to enforce its rights to require that prevailing wages and fringe benefits be paid for the construction work on this Project, but the University shall have no duty or contractual obligation to enforce these provisions. Contractor agrees that it shall be solely responsible for ensuring that these requirements are met and shall handle and defend all complaints or claims regarding wage payments to construction mechanics without assistance or involvement of the University. Contractor shall permit its employees and workers, and its Subcontractors and sub-subcontractors and their employees and workers, to discuss payment and work duty information with University staff, but otherwise Contractor shall continually prohibit its employees and workers, and all subcontractors and sub-subcontractors and their employees and workers, from directing or making any claims or complaints regarding the payment of wages to any employee or official of the University, and shall indemnify and reimburse University for all expenses and fees, including attorney fees, which it incurs for defending or representing itself against such claims or complaints. The University shall not be asked to nor be responsible to address or resolve any disputes with or between Subcontractors on the Project.

5.05 Application to Subcontractors

The Contractor shall include terms identical or substantially similar to this section in all Subcontracts, Purchase Orders and other agreements pertaining to the Project.

6.00 OWNERSHIP OF ELECTRONIC OR HARD-COPY DOCUMENTS

All drawings and specifications and other data and materials prepared and furnished whether in electronic or hard-copy format by the University, the Design Professional and/or the Contractor shall become the property of the University. The Contractor shall have no claim for further employment or additional compensation as a result of exercise by the University of its full rights to ownership of such documents, information, data and materials. The Contractor shall not use or copy such documents, information, data or materials in any format for any purpose other than for the Project.

7.00 SUCCESSORS AND ASSIGNS

This Agreement shall be binding upon and inure to the benefit of the parties to this Agreement and their respective successors and assigns; provided, however, that none of the parties hereto shall assign this Agreement without the prior written consent of the other.

8.00 CLAIMS, DISPUTES AND GOVERNING LAW
8.00 CLAIMS AND DISPUTES

8.01 Claims Definition

A Claim is a demand or assertion by one of the parties seeking adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term “Claim” also includes other disputes and matters in question between the parties arising out of or relating to the Contract. Claims must be made by written notice within a specified time period. The responsibility to substantiate Claims shall rest with the party making the Claim.

8.01.1 Policy of Cooperation

The parties shall endeavor to resolve all of their claims and disputes amicably and informally through open communication and discussion of all issues relating to the Project. To the greatest extent possible, the parties shall avoid invoking the formal dispute resolution procedures contained in the Contract Documents.

8.02 Recommendation of Design Professional

Claims must be referred initially to the Design Professional for action as provided in paragraph 8.10 as an express condition precedent to proceeding further in resolving any claim.

8.03 Time Limits on Claims

Claims must be made within 5 business days after occurrence of the event giving rise to such Claim or within 5 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Claims must be made by written notice. An additional Claim made after the initial Claim has been resolved by Change Order will not be valid.

8.04 Continuing Contact Performance

Pending final resolution of a Claim, unless otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract and the University shall continue to make payments in accordance with the Contract Documents subject to the University's rights relative to payments, withholding of payments, termination, or all other rights afforded it in the Contract Documents.

8.05 Claims for Concealed or Unknown Conditions

If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then written notice by the observing party shall be given to the other party promptly before conditions are disturbed and in no event later than 24 hours after first observance of the conditions. The Design Professional will promptly investigate such conditions and, if the conditions differ materially and cause an increase or decrease in the Contractor’s cost of, or time required for, performance of any part of the Work, the Design Professional will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Design Professional determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Design Professional shall so notify the University and Contractor in writing, stating the reasons. Claims by either party in opposition to such determination must be made within 5 days after the Design Professional has issued such determination. If the University and Contractor cannot agree on an adjustment in the Contract Sum or Contract Time, the
adjustment shall be referred to the Design Professional for initial determination, subject to further proceedings pursuant to Paragraph 8.09.

8.06 Claims for Additional Cost

Any Claim by the Contractor for an increase in the Contract Sum shall be submitted in writing as required by the Contract Documents before proceeding to execute the Work. If the Contractor believes additional cost is involved for reasons including but not limited to (1) a written interpretation from the Design Professional, (2) an order by the University to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the Design Professional, (4) failure of payment by the University, (5) termination of the Contract by the University, (6) University's suspension or (7) changes in the scope of Work, the Contractor's claim shall be filed in strict accordance with the procedure established herein.

8.07 Claims for Additional Time

Any Claim by Contractor for an increase in the Contract Time shall be submitted in writing as required by this provision and the Contract Documents. The Contractor's Claim shall include an estimate of the probable effect of delay on progress of the Work. In the case of a continuing delay only one Claim is necessary.

As a precondition for the Claim to be considered by the University, Contractor must identify the precise activities affected as located on the approved network Project Schedule. Contractor must also describe the efforts that it has made to mitigate the effects of any negative schedule impact.

If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time and location and could not have been reasonably anticipated, and that the abnormal weather conditions had an adverse effect on the scheduled construction.

8.08 Injury or Damage to Person or Property

If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, of any of the other party's employees or agents, or of others for whose acts such party is legally liable, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 5 days after first observance. The notice shall provide sufficient detail to enable the other party to investigate the matter. If a Claim for additional cost or time related to this Claim is to be asserted, it shall be filed as provided in the Contract Documents.

8.09 Verification of Claims Submitted

With respect to any Claim asserted by Contractor for itself or on behalf of a Subcontractor for additional time or cost, the Contractor shall evaluate the claim and verify that any amounts claimed are valid, compiled in accordance with generally accepted accounting principles and are consistent with the terms of the existing contractual agreements regarding entitlement before presentation of the Claim to the Owner. Any Claim not verified in accordance with this requirement shall be denied without further recourse by the Contractor or Subcontractor.

8.10 Resolution of Claims and Disputes

8.10.1 Review by Design Professional

Design Professional will review all Claims and take one or more of the following preliminary actions within 10 days of receipt of a Claim: (1) request additional supporting data from the claimant, (2) submit a schedule to the parties indicating when the Design Professional expects to take action, (3) reject the Claim in whole or in
part, stating reasons for rejection, (4) recommend approval of the Claim by the other party or (5) suggest a compromise. The Design Professional may also, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim.

If a Claim has been resolved, the Design Professional will prepare or obtain appropriate documentation. If a Claim has not been resolved, the party making the Claim shall, within 10 days after the Design Professional’s preliminary response, take one or more of the following actions: (1) submit additional supporting data requested by the Design Professional, (2) modify the initial Claim or (3) notify the Design Professional that the initial Claim stands.

If a Claim has not been resolved after consideration of the foregoing and of further evidence presented by the parties or requested by the Design Professional, the Design Professional will notify the parties in writing that the Design Professional’s opinion will be rendered within 5 days. Upon expiration of such time period, the Design Professional will render to the parties the Design Professional’s written opinion relative to the Claim, including any change in the Contract Sum or Contract Time or both. If there is a surety and there appears to be a possibility of a Contractor’s default, the Design Professional may, but is not obligated to, notify the surety and request the surety’s assistance in resolving the controversy. The opinion of the Design Professional shall be subject to the review of the Vice-President for Finance and Business Operations Wayne State University (VPFBO).

8.10.2 Review by Vice-President for Finance and Business Operations

The Vice-President for Finance and Business Operations (VPFBO) shall review the Design Professional's opinion and the supporting information submitted by the parties for the purpose of upholding the Design Professional's opinion, modifying the Design Professional's opinion, or rejecting the Design Professional's opinion. The VPFBO shall render a decision within forty-five days of the completion of any submissions by the parties. The decision of the VPFBO is final unless it is challenged by either party by filing a lawsuit in the Court of Claims of the State of Michigan within one year of the issuance of the decision.

8.10.3 Jurisdiction

Jurisdiction over all claims, disputes, and other matters in question arising out of or relating to this Contract or the breach thereof, shall rest in the Court of Claims of the State of Michigan. No provision of this agreement may be construed as the University's consent to submit any claim, dispute or other matter in question for dispute resolution pursuant to any arbitration or mediation process, whether or not provisions for dispute resolution are included in a document which has been incorporated by reference into this agreement.

8.10.4 Condition Precedent

The process and procedures described in Section 8.10 are an express condition precedent to filing or pursuing any legal remedy including litigation. Pursuing litigation prior to exhaustion of the Dispute Resolution process set forth herein shall be premature and a material breach of this Agreement.

8.10.5 Governing Law

This Agreement shall be governed by and construed in accordance with the laws of the State of Michigan.

9.00 NON-DISCRIMINATION

9.01 General

The Contractor shall not discriminate against any job applicant, contractor, or employee because of race, color, religion, national origin, age, sex (including gender identity) height, weight, or familial, disability, or
veteran status, and shall include terms identical or substantially similar to this section in all Subcontracts, Purchase Orders and other agreements pertaining to the Project.

9.02 Solicitation/Advertisements

The Contractor shall in all solicitation or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, national origin, age, sex (including gender identity), height, weight, or familial, disability or veteran status.

9.03 Rules/Laws

The Contractor shall comply with all applicable federal and state laws, and current published rules, regulations, directives, and orders of the Michigan Civil Rights Commission and other governmental agencies/departments.

9.04 Reports

The Contractor shall furnish and file compliance reports within such time and upon such forms as provided by the Michigan Civil Rights Commission; these forms may also elicit information as to the practices, policies, program, and employment statistics of the Contractor and of each Subcontractor. The Contractor shall permit access to all books, records, and accounts by the Michigan Civil Rights Commission and/or its agents, for purposes of investigation to ascertain compliance with this contract and with rules, regulations, and orders of the Michigan Civil Rights commission.

9.05 Persons with Disabilities

The Contractor shall comply with the provisions of the Michigan Persons with Disabilities Civil Rights Act (M.C.L. 37.1101, et seq.).

9.06 Contract Provisions

The Contractor shall include, or incorporate by reference, the provisions of this Article in every Subcontract, Subcontract and purchase order unless exempted by the rules, regulations or orders of the Michigan Civil Rights Commission, and shall provide in every Subcontract, subcontract or purchase order that said provisions shall be binding upon each Subcontractor, subcontractor or seller.

10.00 ADDITIONAL PROVISIONS

10.01 Prohibited Contracts or Subcontracts due to Unfair Labor Practices

Public Act No. 278 of 1980 prohibits State of Michigan from awarding Contract or Subcontract to employer who has been found in contempt of court by a Federal court of appeals, on not less than three (3) occasions involving different violations during preceding seven (7) years, for failure to correct unfair labor practice as prohibited by Section 8 of Chapter 372 of National Labor Relations Act, 29 U.S.C. 158. Contractor may not in relation to that Contract subcontract with such employer. The University may rescind, or require Contractor to rescind a contract if the employer or Subcontractor, manufacturer, or supplier of employer subsequently appears in register of such employers which will be compiled by Michigan’s Department of Licensing and Regulatory Affairs, pursuant to Section 2 of Public Act No. 278 of 1980.

10.02 Buy-American
University endeavors to buy products made in the United States of America whenever an American-made product is available that meets or exceeds the specifications requested and the price is equal to or lower than foreign-made product. Vendors and Contractors are instructed to bid American-made products and/or services whenever available. Vendors and Contractors may bid foreign-made products or services when:

1. those products or services are specified, or
2. as an alternate as long as the products or services are technically acceptable to the University and American-made goods or services that are competitively price and of comparable quality are not available.

A product or service shall be considered “American-made” if more than 50% of the product is manufactured or assembled in the United States or more than 50% of the services are performed in the United States.

10.03 Michigan Products

Contractor and its Subcontractors and suppliers shall utilize Michigan-made products whenever possible where price, quality and performance are equal to or better than non-Michigan products.

10.04 Drug and Alcohol Testing

The University is a “DRUG FREE WORKPLACE”, and the University requires Contractors, Subcontractors and sub-subcontractors with access to the work site to abide by the University’s policies on drugs, alcohol and tobacco, which can be found at http://bog.wayne.edu/code/2_20_04.php and http://policies.wayne.edu/administrative/00-03-smoke-free-campus.php. All costs for initial and periodic testing shall be borne by the Contractor.

1. The Contractor and University shall reserve the right to administer drug and alcohol tests to any and/or all site personnel at random periods and without notice.
   
   a. The Contractor shall be responsible for all costs including wages for those individuals testing drug or alcohol-free at the Contractor’s direction.

   b. Subcontractors shall be responsible for all costs including wages for those individuals not testing drug or alcohol-free at the direction of the Contractor, and the Subcontractor shall immediately remove those individuals from the site.

4. Any individual not testing drug or alcohol-free shall not be allowed to return to the site under any circumstances.

10.05 Other University Policies

The University’s policies related to Duty to Report Criminal Acts and Weapons on Campus shall apply to this Project and Contractor shall include this requirement in all Subcontracts, purchase orders and supply agreements.

10.06 University Representative

The University's Representative shall be the Associate Vice President of Facilities Planning and Management, the Senior Director of Design and Construction Services, the Director of Design and Construction Services and the Project Manager. Any project decision on behalf of the University may only be in accordance with the Authorization Matrix that is attached as Exhibit C and incorporated by reference.
11.00 INCLUSION BY REFERENCE

This Contract and Contract Documents hereby include and incorporate by reference the General Conditions of Construction and Supplementary General Conditions, the Request for Proposal by University, the approved plans and specifications, Contractor's Bid or Proposal insofar as it is not inconsistent with the other Contract Documents and other Project documents attached as Exhibits.

Exhibit A – Contractor’s Bid or Proposal
Exhibit B – Basis of Compensation
Exhibit C - Authorization Matrix
Exhibit D – Staffing Plan

12.00 TERMINATION

12.01 Termination by the University for Cause

12.01.1

The University may terminate the Contract if the Contractor: (a) becomes insolvent; (b) files or has filed against it any Petition in Bankruptcy or makes a general assignment for the benefit of its creditors; (c) fails to pay, when due, for materials, supplies, labor, or other items purchased or used in connection with the Work; (d) refuses or fails to prosecute the Work, or any separable part thereof, with such diligence as will ensure the completion of the Work in accordance with the Master Project Schedule; (e) in the University’s opinion, persistently fails, refuses or neglects to supply sufficient labor, material or supervision in the prosecution of the Work; (f) interferes with or disrupts, or threatens to interfere with or disrupt the operations of the University, or any other Contractor, supplier, subcontractor, or other person working on the Project, whether by reason of any labor dispute, picketing, boycotting or by any other reason; or (g) commits any other breach of this Contract.

When any of the above reasons exist, the University may, without prejudice to any other rights or remedies of the University and after giving the Contractor and the Contractor’s surety, if any, three days written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety: (1) take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor; (2) accept assignment of subcontracts; and (3) finish the Work by whatever reasonable method the University may deem expedient.

When the University terminates the Contract for one of the stated reasons, the Contractor shall not be entitled to receive further payment until the Work is finished.

12.01.2

If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Design Professional’s services and expenses made necessary thereby, the remaining balance shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor shall pay the difference to the University. The amount to be paid to the Contractor or University, as the case may be, shall be certified by the Design Professional, upon application, and this obligation for payment shall survive termination of the Contract.

12.02 Suspension by the University for Convenience

12.02.1
The University may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the University may determine.

12.02.2

An adjustment shall be made for increases in the cost and/or time of performance of the Contract, including profit on the increased cost of performance, caused by suspension, delay or interruption. No adjustment shall be made to the extent: (1) that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or (2) that an equitable adjustment is made or denied under another provision of this Contract.

Adjustments made in the cost of performance may have a mutually agreed fixed or percentage fee.

12.03 Termination By The University For Convenience

12.03.1

The University, with or without cause, may terminate all or any portion of the services by the Contractor under this Agreement, upon giving the Contractor 30 days written notice of such termination. In the event of termination, the Contractor shall deliver to the University all reports, estimates, schedules, subcontracts, Contract assignments, purchase order assignments, and other documents and data prepared by it, or for it, pursuant to this Agreement.

12.03.2

Unless the termination is for cause, the Contractor shall be entitled to receive only the payments provided for in Article 4, pro-rated to the date of termination (including payment for the period of the 30-day notice) plus reimbursement for approved and actual costs and expenses incurred by the Contractor to the date of termination. Prior to payment, the Contractor shall furnish the University with a release of all claims against the University.

12.04 Termination By The Contractor

12.04.1

The Contractor may terminate the Contract if the Work is stopped for a period of 60 days through no act or fault of the Contractor or a subcontractor, sub-subcontractor or their agents or employees or any other persons performing portions of the Work under Contract with the Contractor, for any of the following reasons: (1) issuance of an order of a court or other public authority having jurisdiction; (2) an act of government, such as a declaration of national emergency, making material unavailable; (3) because the Design Professional has not approved a Certificate for Payment and has not notified the Contractor of the reason for withholding approval, or because the University has not made payment of undisputed amounts on an approved Certificate for Payment within the time stated in the Contract Documents; (4) if repeated suspensions, delays or interruptions by the University constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

If one of the above reasons exists, the Contractor may, upon seven additional days’ written notice to the University and Design Professional, terminate the Contract and recover from the University payment for Work executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including reasonable overhead and profit.

12.04.2
If the Work is stopped for a period of 60 days through no act or fault of the Contractor or a subcontractor or their agents or employees or any other persons performing portions of the Work under Contract with the Contractor because the University has persistently failed to fulfill the University’s obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days’ written notice to the University and the Design Professional, terminate the Contract and recover from the University as provided in Subparagraph 12.03.2

13.00 COMPLETE AGREEMENT

The Contract Documents constitute the entire agreement between the parties and supersede any prior discussions or negotiations. Any modification of these Contract Documents must be in writing and signed by the duly authorized representatives of the parties.

IN WITNESS WHEREOF, each of the parties has caused this Agreement to be executed by its duly authorized representative on the dates shown beside their respective signatures, with the contract to be effective upon the date set forth above.

CONTRACTOR

Wayne State University

By: ______________________________
Name: ______________________________
Title: ______________________________
Date: ______________________________

Exhibit A – Contractor’s Bid or Proposal

**[GENERAL CONTRACTOR’S NAME] bid/proposal dated ____________.**

Exhibit B – Basis of Compensation

a. The University shall pay the Contractor a not to exceed amount of $$$$$$$ (“Amount in words 00” /100 dollars) based on unit pricing in the proposal which will be adjusted to reflect actual units used for the performance of all work associated with the Contractor’s Base Bid “and Alternates (List)”.

b. List of Alternates. The University may, at its sole discretion, during the life of the contract, award the following alternates at the amounts indicated: (If this section is not used, delete all text and enter_ Deleted)

<table>
<thead>
<tr>
<th>Alternate  1</th>
<th>Amount</th>
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<tbody>
<tr>
<td>Alternate  2</td>
<td></td>
</tr>
<tr>
<td>Alternate  3</td>
<td></td>
</tr>
</tbody>
</table>

c. List of unit prices. In the event additional work becomes necessary, the following unit prices will apply:

“(If section 3.3 is not used, delete all text and enter Deleted)”
d. Liquidated Damages. It is understood and agreed that, if the project is not completed within the time specified in the Agreement plus any extension of time allowed pursuant thereto, the actual damages sustained by the University because of any such delay will be uncertain and difficult to ascertain, and it is agreed that the reasonable foreseeable value of the use of said project by the University would be the sum of $________ (____ Hundred 00/100 dollars) per day. Therefore, the Contractor shall pay as liquidated damages to the University the sum of $________ (____ Hundred 00/100 dollars) per day for each day's delay in substantially completing said project beyond the time specified in this Agreement and any extensions of time allowed thereunder.
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WSU Project No.
Contractor Name

Contractor
WSU
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1.00 DEFINITIONS

Bulletin - A bulletin is defined as a compilation of changes to the scope of the work issued by the Design Professional or University which requests the Contractor to submit a quote for the changes.

Change Order - A written agreement entered into after the award of the Contract which alters or amends the executed Contract.

Claim - A Claim is a demand or assertion by one of the parties seeking adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the parties arising out of or relating to the Contract. Claims must be made by written notice. The responsibility to substantiate Claims shall rest with the party making the Claim.

Close-out Documents - Close-out Documents shall include as-built record drawings and specifications, Operations and Maintenance Manuals, Requests for Information (RFIs), submittals, shop drawings, coordination drawings, warranties, unconditional lien waivers and governing approvals.

Cost of Work - The term Cost of Work, as used herein, is that portion of the Project Cost, that is the estimated or actual labor and material costs of that Work performed (or to be performed) on the Project by the Contractor and all subcontractors, and is inclusive of the cost of construction as described by divisions of the Construction Specifications Institute or other standard format, which constitutes the Direct Cost of Work. However, Cost of Work shall not include the Indirect Cost of Work as herein defined.

Contract - The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a duly executed written Change Order.

Contract Documents - The Contract Documents consist of the bonds, insurance certificates, plans, specifications, drawings, bulletins, addenda, Agreement, General Conditions of Construction, Supplementary General Conditions, Change Orders, Contractor's Bid, and to the extent not otherwise inconsistent with any other Contract Document.

The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Project. Contract Documents are complementary, and what is required by one shall be as binding as if required by all. Performance by the Contractor shall be required to be consistent with the Contract Documents and the highest standard of care. In the case of an inconsistency between, or perceived omission or error in the Drawings, Specifications, or other Contract Documents which is not clarified by addendum or Requests for Information (RFI), or should the Contractor be in doubt as to their exact meaning, the Contractor shall notify the Design Professional and the University at once. The University shall not be responsible for the Contractors misinterpretations of Drawings and Specifications and/or other Contract Documents.

Nothing contained in the Contract Documents shall create a contractual relationship between University and any third party; however, the University is an intended third-party beneficiary of all contracts for design and
engineering services, all subcontracts, purchase orders and other agreements between Contractor or Design Professional and third parties. The Contractor and Design Professional shall incorporate the obligations of the Contract Documents into its respective subcontracts, agreements and purchase orders.

**Contractor:** The term “Contractor” as used in the General Conditions shall include the term “Construction Manager” as used in the Contract for Construction Management Services.

**Contractor's Construction Schedule** - The construction schedules required by the Contract Documents shall be a logic network prepared in the critical path method or other sequential network in use within the construction industry and shall depict: (1) a sequence of operations mutually agreeable to the University, Design Professional and Contractor; (2) the dates of commencement and completion of each task of the Work (including lead time activities, drawing and sample submissions, bidding, awarding Trade Contracts, manufacturing and shipping); (3) delivery dates for materials and equipment; and (4) at the University’s request shall include all Finish Work to be performed by separate Contractors. The construction schedule includes a complete itemized breakdown of the Work.

**Contract Sum** - The Contract Sum shall be the total dollar value of the Agreement between the University and Contractor.

**Delay** – A delay shall be recognized as a time of completion impact on the performance of the Work by the Contractor that extends the overall duration of the Project beyond the substantial completion and final completion dates specified in the Agreement. A delay shall not be recognized if the time of completion impact on the performance of the Work occurs on a non-critical path activity, and does not extend the overall duration of the Project.

**Day** - “Days” means calendar days unless specifically provided to the contrary herein or in the Construction Agreement; provided, however, if any day falls on a weekend or a holiday, same shall refer to the next business day thereafter.

**Design Professional** - The Design Professional is the person lawfully licensed to practice architecture or engineering or an entity lawfully practicing architecture or engineering identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term “Design Professional” means the Design Professional or the Design Professional’s authorized representative.

**Final Completion** - “Final Completion” means the completion of all the Work in accordance with the Contract Documents and the acceptance thereof by the University. Completion of the Work includes (1) full performance of all Contract terms; (2) acceptance of the Work by University; (3) resolution of all outstanding Changes of Contract; (4) completion of all “punch-list” items; and (5) delivery of all Close-out Documents.

**Incomplete Construction List** – The Incomplete Construction List is prepared by the Contractor for review by Design Professional and University identifying Work remaining to be completed at the time of Substantial Completion and the date by which Contractor shall complete the Work on the Incomplete Construction List.

**Knowledge** - The terms "knowledge," "recognize," or "discover," their respective derivatives and similar terms in the Contract Documents, as used in reference to the Contractor, shall be interpreted to mean that which the Contractor knows or should know, recognizes or should reasonably recognize and discovers or should reasonably discover in exercising the care, skill and diligence required by the Contract Documents.

**Master Project Schedule** - The Master Project Schedule shall show the sequence, duration in calendar days, interdependence for the complete performance of all Work. The Master Project Schedule shall begin with the date of issuance of the Notice to Proceed and conclude with the date of final completion.
Notice to Proceed - A "Notice to Proceed" means written notice given by the University to the Contractor fixing the date on which the Contract Time will commence to run and/or on which Contractor shall start to perform Contractor’s obligations under the Contract Documents. A Notice to Proceed by the University shall authorize all or a portion of the Work for the Costs so defined.

Persistently fails - The phrase "persistently fails" and other similar expressions, as used in reference to the Contractor, shall be interpreted to mean any combination of acts and omissions, which cause the University to reasonably conclude that the Contractor will not complete the Work within the Contract Time, or for the Contract Sum or in substantial compliance with the requirements of the Contract Documents.

Plans - The drawings prepared by the Design Professional and accepted by the University which include elevations, sections, details, schedules, diagrams, information, notes, or reproductions or any of these, and which show the location, character, dimension, or details of the Work. These include the graphic and pictorial portions of the Contract Documents as listed in the Agreement.

Preliminary Project Cost and Schedule Impact Report – The direction from the University to perform changed Work in the absence of agreement between the University and Contractor, which may result in a Change Order upon agreement of the cost or schedule impact.

Project - The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the University or by separate Contractors.

Punchlist - Punchlist items shall include all Work remaining on the Contractor's Incomplete Construction List and additional items documented by the Design Professional, Contractor and University and issued to the Contractor and may be issued with a Certificate of Substantial Completion. It is understood and accepted that the Punchlist included with the Certificate of Substantial Completion may not represent all remaining Work for which the Contractor is obligated and that Punchlist may be expanded prior to Final Completion.

Reasonably inferable - The phrase "reasonably inferable" and similar terms in the Contract Documents shall be interpreted to mean reasonably inferable by a Contractor familiar with the Project and exercising the care, skill and diligence required by Contract Documents.

Site - The area specified in the Contract Documents and the area made available for the Contractor's operation.

Soft Costs - "Soft Costs" are those costs derived by the University and shall include, but not be limited to, items such as Environmental services, State administration fees, Design Professional fees, moving furniture, fixtures and equipment, and telecommunications, unless otherwise agreed to by the Parties.

Specifications - The term Specifications shall mean the written instructions and requirements prepared by the Design Professional which complement the plans and which describe the manner of executing the Work or the qualities and types of materials to be furnished.

Statement of Probable Cost - The Statement of Probable Cost, as developed by the Contractor, is essential to the budgetary and management processes of the University. The Statement of Probable Cost, once established and accepted by the University, is relied upon by the University for its subsequent budgetary planning and financial needs for the Project.

The Statement of Probable Cost, applicable to either an estimated or actual cost, is the sum of all costs for a completely constructed, functionally ready-for-use project, in accordance with the scope, scheme, concept, and statement, as developed, documented and accepted by the University, and as constructed by the
accepted contracting method or methods. The Contractor shall provide Statements of Probable Cost as needed during the Project to aid the University and Design Professional in making scope of work selection decisions, especially during design phase and minimally at the end of each design phase of the Project and shall include all costs included in the Contract Sum. The University shall be responsible for the derivation and provision of all Soft Costs that comprise the Project scope and budget.

**Subcontractor** - The term "subcontractor" shall mean any business entity under contract to the Contractor for services on or regarding the Project. The term “Subcontractor” as used in the General Conditions shall be synonymous with the term “Trade Contractor” as used in the Contract for Construction Management Services. Nothing contained in this contract shall create any contractual relationship between the University and any subcontractor. However, the University is the intended third-party beneficiary of all contracts for design, engineering or consulting services, all Trade Contracts, subcontracts, purchase orders and other agreements between the Contractor and third parties. The Contractor shall incorporate the obligations of this Agreement into its respective Trade Contracts, subcontracts, supply agreements and purchase orders.

**Substantial Completion** - "Substantial Completion" shall mean the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the University can occupy or utilize the Work for its intended use. Substantial Completion shall only be determined as described in the Contract Documents.

**Unsafe Persons** – Unsafe persons shall be those individuals that present a safety hazard to themselves or others.

**University** - The University is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "University" means the University or the University’s authorized representative. Any reference to “Board of Governors” shall be considered to mean “University.”

**University's Representative** - The University's Representative shall include the Associate Vice President for Facilities Planning and Management, the Senior Director of Design and Construction Services, the Director of Design and Construction Services and the Project Manager. Any project decision on behalf of the University may only be in accordance with the Authorization Matrix.

**Vice President of Finance and Business Operations** - The Vice President of Finance and Business Operations shall be the level of review over the Associate Vice President of Facilities Planning & Management.

**Work** - The term “Work” means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, licenses, permits, insurance and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.
2.00 BIDDING

2.01 Duty to Carefully Examine These Instructions

Prospective bidders for this project shall carefully examine the instructions contained herein and be cognizant of and satisfied with the conditions which must be satisfied prior to submitting a proposal and to the conditions which affect the award of the Contract.

2.02 Disclosure of Bidders

The Contractor shall only accept proposals from Subcontractors who are acceptable to the University.

2.03 Clarification During Bidding

The Contractor shall examine the plans and specifications in preparing the bid and shall immediately report to the Design Professional any omissions, discrepancies, or apparent errors found in the plans and specifications. Prior to the date of bid opening, bidders shall submit a written request for clarification in accordance with the instruction contained in the request for bids. If time permits, such clarification shall be issued in the form of addenda to all bidders.

2.04 Bidding Documents

2.04.1 Bid Proposal Package

Each bidder will receive a bid proposal package containing a standard proposal form which shall be used for bidder’s proposal. Each proposal shall give the prices proposed in the manner required by the proposal and shall be signed by the bidder or the bidder’s duly authorized representative, with its address and telephone number. If the proposal is made by an individual, the individual’s name, postal address, and telephone number must be shown. If made by a partnership, the proposal shall have the signature of all partners or an affidavit signed by all partners empowering one partner as an agent to act in their behalf and the address and telephone number of the partnership. A proposal submitted by a corporation shall show the name of the state in which the corporation is chartered, the name of the corporation, its address and telephone number, and the title of the person who signs on behalf of the corporation.

2.04.2 Listing of Proposed Subcontractors Acceptable to the University

The Contractor will require every subcontractor to provide the name and location of the place of business of each Subcontractor and subordinate Subcontractor which will perform work or labor or render services for the Project.

2.04.3 Bidder’s Security

All bids shall be presented under sealed cover and have enclosed an amount as directed in the instructions to bidders as bid security. The bid security may be a cashier’s check made payable to Wayne State University or as otherwise directed in the instructions to bidders.

2.05 Bid Proposals

2.05.1 Submission of Proposals
Proposals shall be submitted to the office indicated on the bid proposal. It is the responsibility of the bidder to see that its bid is received in the proper time. Delays in timely receipt of the bid caused by the United States or the University mail system, independent carriers, acts of God, or any other cause shall not excuse late receipt of a bid. Any bid received after the scheduled closing time for receipt of bids shall not be considered and will be rejected by the University, opened, retained by the University or returned to the bidder unopened.

2.05.2 Withdrawal of Proposals

Any bid may be withdrawn at any time prior to the time fixed for receiving bids but only by a written request from the bidder or its authorized representative filed with the University. An oral, faxed, or telephonic request to withdraw a bid proposal is not acceptable. The withdrawal of a bid shall not prejudice the right of a bidder to file a new bid. This paragraph does not authorize the withdrawal of any bid after the time fixed for receiving bids.

2.05.3 Public Opening of Proposals – SECTION DELETED

2.05.4 Rejection of Irregular Proposals

Proposals may be rejected if they show any alterations of forms, additions not called for, conditional bids, incomplete bids, erasures, or irregularities of any kind. If the bid amount is changed after the amount has been once inserted, the change shall be initialed.

2.05.5 Power of Attorney or Agent

When proposals are signed by an agent, a power of attorney shall either be on file with the University prior to the opening of bids or be submitted with the proposal. Failure to submit a power of attorney may result in the rejection of the proposal as irregular and unauthorized. A power of attorney is not necessary in the case of a general partner of a partnership.

2.05.6 Waiver of Irregularities/University’s Right to Reject Bids

The University reserves the right to waive any or all irregularities in proposals submitted. The University reserves the right to reject any or all of the bids submitted.

2.05.7 Exclusion from Contract Documents

Nothing in any of the bidding documents, including but not limited to Request for Proposal form, Notice to Contractors, Proposal by Contractor and Design Professional and bids including any attachments or exhibits by Contractor, shall be considered part of the Contract Documents unless specifically incorporated.

2.06 Mistake in Bid

A bidder shall not be relieved of a bid nor shall any change be made in a bid because of mistakes without consent of the University. Failure by the Contractor to honor its proposal following the opening of bids for any reason shall result in the forfeiture of the Bid Security and possible suspension from future work consideration by and with the University.

2.07 Non-Discrimination

Wayne State University is an affirmative action/equal opportunity employer. The University has a strong commitment to the principle of diversity in all areas.
The Contractor and all Subcontractors shall not discriminate against any employee or applicant for employment because of race, color, religion, national origin, age, sex (including gender identity), height, weight or familial, disability or veteran status. The Contractor will ensure that applicants are employed and that employees are treated during employment, without regard to their race, color, religion, national origin, age, sex (including gender identity), height, weight or familial, disability, or veteran status. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor shall, in all solicitation or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, national origin, age, (including gender identity), height, weight or familial, disability or veteran status.

The Contractor shall comply with all requirements of the Elliott-Larsen Civil Rights Act being 1976 PA 453, as amended.

The Contractor shall also comply with the Persons with Disabilities Civil Rights Act being 1976 PA 220, as amended.

The Contractor shall include, or incorporate by reference, the provisions of this Article 2.07 in each and every subcontract or purchase order and shall provide in each and every subcontract or purchase order that said provisions will be binding upon each and every subcontractor and Supplier and Vendor.

Any breach of the requirements and covenants of this Article 2.07 shall constitute a material breach of the Contract Documents.
3.00 AWARD AND EXECUTION OF CONTRACT

3.01 Contract Bonds and Insurance

3.01.1 Payment and Performance

The Contractor shall forward to the University fully executed Payment & Performance Bonds in the amount of 100 percent of the Contract value on the AIA Form 312 or an equivalent form that is acceptable to the University and in compliance with MCL 129.201 et seq, within five (5) days after execution of the Agreement.

In the same five (5) day period the Contractor shall present to the University, in an acceptable form, evidence of the insurance as required by the Contract Documents. Actual Work shall not commence until the bond and insurance is received by the University. Failure to provide the bond and insurance in the time-frame allowed shall not be cause for an extension of Contract Time.

All alterations, extensions of time, extra and additional work, and other changes authorized by any part of the Contract, including determinations made under Article 7.00, Claims and Disputes, shall be made without securing the consent of the surety or sureties on the Contract bonds.

Whenever the University has cause to believe that the surety has become insufficient, the University may demand in writing that the Contractor provide such further bonds or additional surety, not exceeding that originally required, as in the University’s opinion is necessary, considering the extent of the work remaining to be done. Thereafter no payment shall be made to the Contractor or any assignee of the Contractor until the further bonds or additional surety have been furnished.

Contract bonds shall remain in full force and effect during the repair and guarantee period required by the Contract Documents.

3.02 Execution of Contract

The Contract shall be signed by the Contractor in three (3) duplicate counterparts and returned to the University within five days of receipt from the University, not including Saturdays, Sundays, or legal holidays. No Contract shall be binding upon the University until it has been executed by the Contractor and a University official in accordance with the Authorization Matrix.

3.03 Failure or Refusal to Execute Contract

Failure or refusal by the Contractor to execute the Contract within the time set in Section 3.02 shall be just cause for the rescission of the award and the forfeiture of bidder’s security. Failure or refusal to file acceptable bonds within the time set in Section 3.01 constitutes a failure or refusal to execute the Contract. If the Contractor fails or refuses to execute the Contract, the University may award the Contract to another contractor and the Contractor shall forfeit his Cashier’s Check.
4.00 RESPONSIBILITIES OF THE PARTIES

4.01 University

4.01.1 Information and Services Required of the University

The University shall make available existing surveys describing physical characteristics, legal limitations and utility locations for the site of the Project. The University does not warrant or guarantee the accuracy of the information provided.

Unless otherwise agreed to, the University shall be responsible for the abatement of asbestos containing materials and/or site related environmental hazards. The University will provide documentation regarding the presence of asbestos containing materials or other possible environmental hazards to the Contractor. Second opinions on previously documented clean conditions shall be provided at the Contractor's expense. Positive results regarding environmental hazards shall become the University's obligation. If, during the execution of the Work, previously unknown environmental hazards are encountered, the University shall be allowed a reasonable amount of time to abate environmental hazards.

The University shall provide available information regarding requirements for the Project including plans and specifications for the buildings and a survey of the site where required. The Contractor shall review the plans and specifications and survey, if provided, for errors, inconsistencies, ambiguities or omissions as required by Article 4.02.2, Review of Contract Documents and Field Conditions by Contractor. In the event errors, inconsistencies, ambiguities or omissions in the plans, drawings, and specifications were not reasonably identifiable in the Contractor's review as specified in Article 4.02.2, Review of Contract Documents and Field Conditions by Contractor, and such errors, inconsistencies, ambiguities or omissions result in changes in time and cost, the University may make reasonable adjustment in the Contract Sum in accordance with Article 6.00, CHANGES IN THE WORK of the General Conditions.

Except for permits and fees, which are the responsibility of the Contractor under the Contract Documents, the University shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

Information or services under the University's control shall be furnished by the University with reasonable promptness to avoid delay in orderly progress of the Work.

All reproduction required for construction is the obligation of the Contractor.

4.01.2 University's Right to Stop the Work

If, in the University's determination, the Contractor fails to correct work which is not in accordance with the requirements of the Contract Documents as required, or persistently fails to carry out work in accordance with the Contract Documents, the University Representative, by written order may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the University to stop the Work shall not give rise to a duty on the part of the University to exercise this right for the benefit of the Contractor or any other person or entity.

It is understood that while the Contractor is fully responsible for the safety of the jobsite, and for the methods of its execution, if the University deems that the Contractor is failing to provide safe conditions, the University may stop or restrict the Work under such conditions. However, this right shall not create such duty on the University. Under no circumstance shall the Contractor be granted a time extension or Contract Sum
increase for conditions resulting by a stop work order occurring as a consequence of the Contractor’s failure to maintain safe working conditions.

4.01.3 University's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a three (3) day period after receipt of written notice from the University to commence and continue correction of such default or neglect with diligence and promptness, the University may after such three (3) day period, without prejudice to other remedies the University may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Design Professional's additional services and expenses made necessary by such default, neglect or failure. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the University.

4.01.4 University’s Right to Audit

4.01.4.1

Contractor’s records, which shall include but not be limited to accounting records (hard copy, as well as computer readable data if it can be made available), written policies and procedures; subcontract files (including proposals of successful and unsuccessful bidders, bid recaps, etc.); original estimates; estimating work sheets, correspondence; change order files (including documentation covering negotiated settlements); backcharge logs and supporting documentation; general ledger entries detailing cash and trade discounts earned, insurance rebates and dividends; and any other supporting evidence deemed necessary by the University to substantiate changes related to the Agreement (collectively referred to as "Records") shall be maintained in accordance with Generally Accepted Accounting Principles and open to inspection and subject to audit and/or reproduction by University's agent or its authorized representative to the extent necessary to adequately permit evaluation and verification of Cost of the Work, and any invoices, change order, payments or claims submitted by the Contractor or any of his payees pursuant to the execution of the contract that are or have been charged on a basis other than a lump sum approved in writing by the University.

4.01.4.2

Such audits may require inspection and copying from time to time and at reasonable times and places of any and all information, materials and data of every kind and character, including without limitation, records, books, papers, documents, subscriptions, recordings, agreements, purchase order, leases, contracts, commitments, arrangements, notes, daily diaries, superintendent reports, drawings, receipts, vouchers and memoranda, and any and all other agreements, sources of information and matters that may in University's judgment have any bearing on or pertain to any matters, rights, duties or obligations under or covered by any Contract Documents. Such records subject to audit shall also include, but not be limited to, those records necessary to evaluate and verify direct and indirect costs, (including overhead allocations) as they may apply to costs associated with this Agreement.

4.01.4.3

The University or its designee shall be afforded access to all of the Contractor’s Records, and shall be allowed to interview any of the Contractor's employees, pursuant to the provisions of this article throughout the term of this contract and for a period of five (5) years after Final Payment or longer if
required by law. To the extent feasible, the Construction Manager’s records shall remain confidential, and the University’s third party auditors will enter into a confidentiality agreement between and among the University, the third-party auditor and the Contractor prior to any audits being conducted.

4.01.4.4

Contractor shall require all Subcontractors and material suppliers (payees) to comply with the provisions of this article by insertion of the requirements hereof in a written agreement between Contractor and payee so as to allow the University to verify any amounts charged to the Project by a payee on a basis other than a lump sum approved in writing by the University. Such requirements will also apply to Subcontractors and all lower tier Subcontractors. Contractor shall cooperate fully and shall cause all of Contractor’s Subcontractors to cooperate fully by furnishing or making available to University from time to time whenever requested in an expeditious manner any and all such information, materials and data.

4.01.4.5

University’s agent or its authorized representative shall have access to the Contractor’s facilities, shall have access to all necessary records; and shall be provided adequate and appropriate work space, in order to conduct audits in compliance with this article.

4.01.4.6

Contractor agrees that University’s designee shall have the right to examine the Contractor’s records (during the contract period and up to five (5) years after Final Payment is made on the contract) to verify the accuracy and appropriateness of the pricing data used to price change proposals or claims. Contractor agrees that if the University determines the cost and pricing data submitted (whether approved or not) was inaccurate, incomplete, not current or not in compliance with the terms of the contract regarding pricing of change orders, an appropriate contract price reduction will be made. Such post-approval contract price adjustments will apply to all levels of contractors and/or subcontractors and to all types of change order proposals specifically including lump sum change orders, unit price change orders and cost-plus change orders.

4.01.4.7

If an audit, inspection or examination in accordance with this article, discloses overcharges (of any nature) by the Contractor to the University in excess of five percent (5%) of the total contract billings, the actual cost of the University’s audit shall be reimbursed to the University by the Contractor. Any adjustments and/or payments which must be made as a result of any such audit or inspection of the Contractor’s invoices and/or records shall be made within a reasonable amount of time (not to exceed 90 days) from presentation of University’s findings to Contractor.

4.02 Contractor

The Contractor recognizes the relationship of trust and confidence established between the University and the Contractor by this Contract. The Contractor shall furnish the University with its best skill and judgment and fully cooperate with the University in furthering its best interests. All the Work is to be done in the best manner by persons skilled in the type of Work to be performed.
4.02.1 Contractor's Responsibility for the Work

The Contractor shall be responsible to the University for all Work performed under this Contract. For purposes of assessing responsibility to the Contractor by the University, all persons engaged in the Work shall be considered employees of the Contractor. The Contractor shall give its personal attention to the fulfillment of the Contract and keep all phases of the Work under its control.

4.02.2 Review of Contract Documents and Field Conditions by Contractor

The Contractor shall have a continuing duty to read, carefully study and compare the Contract Documents as defined in Article 1.00, DEFINITIONS, and product data with each other and with information furnished by the University. The Contractor shall perform construction coordination and constructability review of the Contract Documents and shall at once report to the Design Professional and the University, any errors, inconsistencies, ambiguities and omissions before proceeding with the affected Work. The Contractor shall be liable to the University for damage resulting from the Contractor's failure to properly perform such reviews or failure to promptly report any errors, inconsistencies, ambiguities or omissions identified in the Contract Documents to the Design Professional and the University. If the Contractor performs any construction activity that involves such error, inconsistency, ambiguity or omission in the Contract Documents without such notice to the Design Professional and the University, the Contractor shall assume responsibility for such performance and shall bear all costs attributable for correction. If the Contractor submits authorized substitutes that cost in excess of the Contract Sum or which cause coordination conflicts, the Contractor shall bear all costs attributable to correction.

The Contractor shall perform the Work in accordance with the Contract Documents.

The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the Design Professional and University at once.

4.02.3 Supervision and Construction Procedures

The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible to the University for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless Contract Documents give other specific instructions concerning these matters.

The Contractor shall be responsible to the University for acts and omissions of the Contractor's employees, subcontractors and their agents and employees, and other persons performing portions of the Work under a Contract with the Contractor.

The Contractor agrees to furnish efficient business administration, coordination, supervision and superintendence of the Work and to furnish at all times a competent and adequate administrative and supervisory staff and an adequate supply of workmen and materials to perform the Work in the best and most sound way in the most expeditious and economical manner consistent with the interests of the University. The Contractor agrees from time to time at the University's request to furnish estimates and technical advice as to construction methods and equipment to the University and Design Professional.

The Contractor agrees to cooperate with the Design Professional, University's Representative, commissioning agents, and all persons or entities retained by the University to provide consultation and advice, and to coordinate the Work with the Work of such parties so that the Project shall be completed in the most efficient
and expeditious manner. In the event that Contractor's failure to efficiently sequence or coordinate the Work results in additional costs to the University, the Contractor shall promptly reimburse the University for the actual costs incurred. Contractor shall remain responsible for any delays resulting from its failure to efficiently coordinate and schedule the Work; any delays or extensions shall be addressed as provided in Sections 4.08, 4.09 and 4.10 of these General Conditions.

4.02.4 Quality Control

The Contractor shall be fully responsible for the quality of materials and workers' skill in the Project. The Contractor shall not rely upon the inspection and testing provided by the University or Design Professional other than those special inspections and tests performed at the University's direction for which there are written reports. Reports issued by the University's commissioning agent are to be considered complementary in nature and in no way relieve the Contractor of its responsibility to deliver Work in compliance with the Contract Documents.

The Contractor shall inspect the Work of the subcontractors on the Project, while the Work is being performed through final completion and acceptance of the Project by the University to assure that the Work performed and the materials furnished are in strict accordance with the drawings and specifications; the Contractor shall also inspect the Work to verify that Work on the Project is progressing on schedule.

The Contractor shall be responsible for inspection of portions of Work performed under this Contract to determine that such portions are in proper condition to receive subsequent Work. In the event that it becomes necessary to interpret the meaning and intent of the plans and specifications during construction and the meaning is not reasonably inferable, the Contractor shall submit, as a Request for Information (RFI) to the Design Professional to make the interpretation in writing and transmit same to appropriate Subcontractors and the University in accordance with the procedures established in section 5.02 of these General Conditions.

The Contractor shall not be relieved of obligations to performing the Work in accordance with the Contract Documents either by activities or duties of the Design Professional in the Design Professional's administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

4.02.5 Labor and Materials

The Contractor shall provide an analysis of the types and quantity of labor required for the Project and review the availability of the appropriate categories of labor required for all Work, and the Contractor shall be responsible to provide the necessary and adequate labor needed to complete the Project by the Contract Time. During the course of the Project, the Contractor shall endeavor to maintain harmonious labor relations on the Project.

Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

Unless otherwise noted in the Information to Bidders, the Contractor shall provide and pay for water, heat, electric and other utilities.

The Contractor shall enforce strict discipline and good order among the Contractor's employees and Subcontractors and others carrying out the Work of the Contract. The Contractor shall not permit employment of unsafe persons or persons not skilled in tasks assigned to them.
4.02.6 Disputes with Subcontractors

Wherever any provision of any section of the Plans and Specifications conflicts with any agreement or regulation of any kind at any time in force among members of any Trade Associations, Unions or Councils which regulate or distinguish what Work shall or shall not be included in the Work of any particular trade, the Contractor shall make all necessary arrangements to reconcile any such conflict without delay, damage, increase to the Contract Sum or recourse to the University. The University will not arbitrate disputes among subcontractors nor between the Contractor and one or more subcontractors concerning responsibility for performing any part of the Project.

In case the progress of the Work is affected by any undue delay in furnishing or installing any items of material or equipment required under the Contract Documents because of conflict involving any agreement or regulation of the type described above, the University’s Representative may require that other material or equipment of equal kind and quality be provided at no additional cost to the University.

4.02.7 Project Manager and Superintendent

The Contractor shall have at the Project site, during the full term of the Contract, an approved, competent project staff, which may include a Project Manager and Superintendent, and any necessary assistants, all satisfactory to the University’s Representative and in accordance with the Contract Documents and the Contractor’s Staffing Plan. The Project Manager or the Superintendent shall not be changed, except with the written consent of the University’s Representative unless the Project Manager or the Superintendent ceases to be in the employ of the Contractor. The Project Manager or the Superintendent shall represent the Contractor and all directions given to either of them by the University or the University’s Representative shall be as binding as if given to the Contractor. All directions and communications shall be confirmed in writing.

If a Project Manager or a Superintendent approved by the University’s Representative ceases to be in the Contractor’s employ, the Contractor shall immediately replace him with a person acceptable to the University’s Representative. The University in its sole discretion shall have the right to require the removal of any agent or employee of the Contractor or any subcontractor without cause at any time.

4.02.8 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work or portions thereof provided by the Contractor which are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect and such taxes are included in the Contract Sum.

4.02.9 Permits and Notices

The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations, policies and lawful orders of public authorities and the University bearing on performance of the Work.

4.02.10 Allowances

The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such stated amounts including identified unit cost, but the Contractor shall not be required to employ persons or entities against which the Contractor makes reasonable objection. Unless otherwise provided in the Contract Documents:

1. materials and equipment under an allowance shall be selected promptly by the University to avoid delay in the Work;
2. allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

3. the Contractor’s costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the allowances;

4. if allowance assumptions prove inappropriate, the Contract Sum may be adjusted accordingly by Change Order. The amount of the Change Order shall reflect the difference between actual costs and the allowances.

4.02.11 Use of Site

The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the site with materials or equipment. The site shall be safely maintained and kept clean, orderly and neat.

4.02.12 Safety

The Contractor shall protect adjoining property and nearby buildings, roads, and other facilities and improvements from dust, dirt, debris and other nuisances arising out of Contractor’s operations or storing practices. Dust shall be controlled by sprinkling, misting or other effective methods acceptable to University and in accordance with legal requirements. An erosion and sedimentation control program shall be initiated, which includes measures addressing erosion caused by wind and water and sediment in runoff from site. A regular watering program shall be initiated to adequately control the amount of fugitive dust.

The Contractor is knowledgeable of and understands that the University may intend to maintain occupancy of certain portions of the existing facility. The Contractor shall exercise caution at all times for the protection of persons and their property. The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to: (1) employees on the Work site together with Subcontractors and other persons who may be affected thereby; (2) the Work and materials and equipment to be incorporated therein, whether in storage on or offsite, under care, custody or control of the Contractor or the Contractor’s Subcontractors or sub-subcontractors; and (3) other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction. The Contractor shall install adequate safety guards and protective devices for all equipment and machinery, whether used in the Work or permanently installed as part of the Project.

The Contractor shall also provide and adequately maintain all proper temporary walks, roads, guards, railings, lights, and warning signs. The Contractor shall comply with all applicable laws relating to safety precautions. The Contractor shall establish and maintain and update as required a Project Specific Safety Program.

The Contractor shall designate a responsible member of the Contractor’s organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor’s superintendent unless otherwise designated by the Contractor in writing to the University and Design Professional.

The Contractor shall require each and every one of its subcontractors and Trade Contractors to comply with all of the provisions of this section.

The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.
In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in the Contract.

4.02.13 Hazardous Condition

The University and/or the Design Professional may bring to the attention of the Contractor a possible hazardous situation in the field regarding the safety of personnel on the site. The Contractor shall be responsible for verifying that all local, state, and federal workplace safety guidelines are being observed. In no case shall this right to notify the Contractor absolve the Contractor of its responsibility for monitoring safety conditions. Such notification shall not imply that anyone other than the Contractor has assumed any responsibility for field safety operations.

Explosives shall not be used without first obtaining written permission from the University and then shall be used only with the utmost care and within the limitations set in the written permission and in accordance with prudence and safety standards required by law. Storage of explosives on the Project site or University is prohibited. Powder activated tools are not explosive for purposes of this Article; however, such tools shall only be used in conformance with State safety regulations.

The Contractor shall report in writing to the University's Representative, within eight (8) hours, all accidents whatsoever arising out of, or in connection with, the performance of the Work, whether occurring on or off the Site, which caused death, personal injury or property damage, giving full details and statements of witnesses. In addition, if death or serious injuries or serious damages are caused, the accident shall be reported immediately by telephone or messenger to the University Representative and the University Police at (313) 577-2222. If any claim is made by anyone against the Contractor or any subcontractor on account of any accident, the Contractor shall report promptly the facts in writing to the University's Representative, giving full details of the claim.

4.02.14 Cutting, Patching and Sequencing

The Contractor shall be responsible for all cutting, fitting or patching required to complete the Work and to ensure the complete and effective coordination of the Work.

The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the University or separate Contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the University or a separate Contractor except with written consent of the University and of such separate Contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the University or a separate Contractor the Contractor’s consent to cutting or otherwise altering the Work.

4.02.15 Access to Site

The Contractor shall at all times permit the University and the Design Professional to visit and observe the Work, and the shops where Work is in preparation, and shall maintain proper facilities and provide safe access for such observation. Work requiring testing, observation or verification shall not be covered up without such test, observation, or approval. Appropriate advance coordination of such testing, observation or verification is expected. University must provide prior written approval for any work to be performed on a Saturday, Sunday, or holiday. In the event that Contractor desires to perform Work on a weekend or holiday, Contractor shall provide a minimum of 48 hours written notice to the University of such desire prior to performing such Work. However, if the Work involves an actual or potential interruption to a utility or service, the Contractor shall provide no less than seven (7) days' written notice to the University.
The Contractor acknowledges that during the performance of the Work, the affected building and surrounding campus buildings will remain occupied and will require access by the public. The Contractor further acknowledges that other Contractors will be working on or near the Project site to accomplish the University’s purposes and projects. To the greatest extent possible, the Contractor shall cooperate fully with the University and its guests, students, employees, invitees, and other Contractors in performing the Work required under the Contract. The Contract Sum includes any and all reasonably necessary costs expended to minimize interference with the University’s activities as well as to coordinate schedules with other contractors’ projects as required by the University.

4.02.16 Burden for Damage

From the issuance of the official Notice to Proceed until the formal acceptance of the Project by the University, the Contractor shall have the charge and care of and shall bear all risk of damage to the Project and materials and equipment for the Project other than damage directly caused by the University or the University’s other contractors.

4.02.17 Payments by Contractor

The Contractor agrees to promptly pay all subcontractors upon receipt of each progress payment, unless otherwise agreed in writing by the parties, the respective amounts allowed Contractor on account of the Work performed by its subcontractors to the extent of each such subcontractor’s interest therein.

In the event the University becomes informed that the Contractor has not paid a subcontractor as herein provided, the University shall have the right, but not the duty, to issue future checks in payment to the Contractor of amounts otherwise due hereunder naming the Contractor and such subcontractor as joint payees. Such joint check procedure, if employed by the University, shall create no rights in favor of any person or entity beyond the right of the named payees to payment of the check and shall not be deemed to commit or obligate the University to repeat the procedure in the future. This provision shall not supersede the procedures set forth in Article 8.00 of these General Conditions.

4.02.18 Responsibility to Secure and Pay for Permits, Licenses, Utility Connections, Etc.

The Contractor shall secure all permits and licenses required for any operations required under this Contract and shall pay all costs relating thereto as well as all other fees and charges that are required by the United States, the State, the county, the city, a public utility, telephone company, special district, or quasi-governmental entity. It is the responsibility of the Contractor to ascertain the necessity of such permits and licenses in preparing its bid, Contract Sum and include in its bid, Contract Sum the cost thereof, as well as any time requirements for securing such permits and licenses.

4.02.19 Patented or Copyrighted Materials

The Contractor shall pay all royalties and license fees for the use of patented or copyrighted processes or materials. The Contractor shall defend suits or claims for infringement of patent rights and shall hold the University and Design Professional harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Design Professional and University in writing.

4.02.20 Property Rights in Materials and Equipment
Nothing in the Contract shall be construed as vesting in the Contractor any property right in the materials or equipment after the materials or equipment have been attached to or permanently placed in or upon the Work or the soil or after payment has been made for fifty percent or more of the value of the materials or equipment delivered to the site of the Work whether or not they have been so attached or placed. All such materials or equipment shall become the property of University upon being so attached or placed, or upon payment of fifty percent or more of the value of the materials or equipment delivered on the site but not yet installed and the Contractor warrants that all such property shall pass to the University free and clear of all liens, claims, security interests, or encumbrances.

4.02.21 Utilities
The Contractor shall refer to and abide by the policies included in the Supplementary General Conditions and shall provide the notices as required by University’s Utility Disturbance and Interruption Request form.

The Contractor shall provide as-built drawings of all utilities encountered and constructed for the University, indicating the size, horizontal location, and vertical location based on the Project benchmark or a stable datum.

Unless otherwise specifically stated, the Contractor shall provide or otherwise make all arrangements for utilities required to deliver the Work.

4.02.22 Asbestos and Hazardous Materials
The Contractor is prohibited from installing any asbestos containing materials or products, and other prohibited and hazardous materials in the Work. The Contractor shall be responsible for removal and replacement costs should it be determined this provision has been violated, regardless of whether the job has been completed.

4.02.23 Photographic Site Survey
Contractor shall perform a photographic survey of construction site and adjoining structures prior to commencing Work. The survey shall be provided to the University and shall include photographs of pathways, flat concrete paving, foundations, walls, landscaping.

4.02.24 Compliance with University Policies on Drugs, Alcohol and Tobacco.
The University requires Contractors, Subcontractors and sub-subcontractors with access to the work site to abide by the University’s policies on drugs, alcohol and tobacco, which can be found at: http://bog.wayne.edu/2_20_04.php and http://policies.wayne.edu/administrative/00-03-smoke-free-campus.php. All costs for initial and period testing shall be borne by the Contractor.

1. The Contractor and University shall reserve the right to test any and/or all site personnel at random periods and without notice.
   a. The Contractor shall be responsible for all costs including wages for those individuals testing drug or alcohol-free at the Contractor’s direction.
   b. Subcontractors shall be responsible for all costs including wages for those individuals not testing drug or alcohol-free at the direction of the Contractor, and the Subcontractor shall immediately remove those individuals from the site.

2. Any individual not testing drug or alcohol-free shall not be allowed to return to the site under any circumstances.
4.03 Design Professional

4.03.1 Design Professional's Administration of Contract

The Design Professional will provide one or more Project Representatives to assist in the administration of the Contract as described in the Contract Documents, and to assist the University's Representative (1) during the construction, (2) until final payment is due and (3) with the University's concurrence, from time to time during the correction and warranty period. The Design Professional will advise and consult with the University on issues relating to contract performance and interpretation. The Design Professional will have no authority to act on behalf of the University except as provided in the Contract Documents, unless otherwise modified by written instrument in accordance with other provisions of the Contract.

The Design Professional will visit the site at intervals defined in the Design Professional's Proposal to become familiar with the progress and quality of the completed Work and to determine if the Work is being performed in a manner indicating that the Work, when completed, will be in accordance with the Contract Documents. On the basis of on-site observations, the Design Professional will keep the University and Contractor informed of progress of the Work by written field reports, and will endeavor to guard the University against defects and deficiencies in the Work.

The Design Professional will not have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility. The Design Professional will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. The Design Professional will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, subcontractors, or their agents or employees, or of any other persons performing portions of the Work.

4.03.2 Communications Facilitating Contract Administration

The Design Professional and Contractor shall communicate directly concerning the Project and shall keep the University advised of their communications. Communications by and with the Design Professional's consultants shall be through the Design Professional. Communications by and with subcontractors and material suppliers shall be through the Contractor. Communications by and with separate Contractors shall be through the University.

4.03.3 Evaluation of Applications for Payment

Based on the Design Professional's observations and evaluations of the Contractor's Applications for Payment, the Design Professional must approve and sign any Contractor Applications for Payment as an express condition precedent to release of any progress or final payment. In the absence of Design Professional, the University will review and authorize applications for payment.

The Design Professional will have authority to reject Work which does not conform to the Contract Documents. Whenever the Design Professional considers it necessary or advisable for implementation of the intent of the Contract Documents, the Design Professional will have authority to require additional observation or testing of the Work in accordance with section 5.06, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Design Professional nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Design Professional to the Contractor, subcontractors, material and equipment suppliers, their agents or employees, or other persons performing portions of the Work.
4.03.4 Review of Shop Drawings, Product Data and Samples

The Design Professional shall review and approve or take other appropriate action upon the Contractor's submittal of Shop Drawings, Product Data and Samples. The Design Professional's action will be taken within 10 days from receipt so as not to cause delay in the Work or in the activities of the University, Contractor or separate Contractors, while allowing sufficient time in the Design Professional's professional judgment to permit adequate review. Review of such submittal is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Design Professional's review of the Contractor's submittal shall not relieve the Contractor of the obligations under Article 5.04. The Design Professional's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Design Professional, of any construction means, methods, techniques, sequences or procedures. The Design Professional's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

4.03.5 Site Observations to Determine Substantial and Final Completion

The Design Professional will conduct observations to determine the date or dates of Substantial Completion and the date of Final Completion, will receive and forward to the University for the University's review and retention all written warranties and related documents required by the Contract and assembled by the Contractor, and will issue an approval of final payment upon compliance with the requirements of the Contract Documents.

4.04 Delegation of Performance and Assignment of Money Earned

The performance of all or any part of this Contract may not be delegated by the Contractor or Design Professional without the written consent of the University. Consent will not be given to any proposed delegation which would relieve the Design Professional, the Contractor or its surety of their responsibilities under the Contract.

The Contractor may assign moneys due or to become due under the Contract, only upon written consent of the University. Assignments of moneys earned by the Contractor shall be subject to proper retention in favor of the University and to all deductions provided for in the Contract and such moneys shall be subject to being used by the University for the completion of the Work in the event the Contractor is in default. Any assignment attempted without the written consent of the University shall be void.

4.05 Contractor's Insurance

The Contractor shall not commence Work under this Contract until it has obtained all the insurance required by the Contract Documents and such insurance has been approved by the University; likewise, no subcontractor or subconsultant shall be allowed to commence Work until the insurance required has been obtained. The Contractor shall, at its expense, purchase and maintain in full force and effect such insurance as will protect itself and the University from claims, such as for bodily injury, death, and property damage, which may arise out of or result from the Work required by the Contract Documents, whether such Work is done by the Contractor, by any subcontractor, by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable. The types of such insurance and any additional insurance requirements are specified herein with the amounts and limits set forth in the Supplementary General Conditions.

4.05.1 Policies and Coverage
The following policies and coverages shall be furnished by the Contractor:

(1) Comprehensive or Commercial Form General Liability Insurance on an “Occurrence” form covering all Work done by or on behalf of the Contractor and providing insurance for bodily injury, personal injury, property damage, and Contractual liability. Except with respect to bodily injury and property damage included within the products and completed operations hazards, the aggregate limit shall apply separately to work required of the Contractor by these Contract Documents. This insurance shall include the contractual obligations assumed under the Contract Documents and specifically section 4.06.

(2) Business Automobile Liability Insurance on an “Occurrence” form covering owned, hired, leased, and non-owned automobiles used by or on behalf of the Contractor and providing insurance for bodily injury, property damage, and Contractual liability.

(3) Worker’s Compensation and Employer’s Liability Insurance as required by Federal and Michigan law. The Contractor shall also require all of its Subcontractors to maintain this insurance coverage. The Contractor acknowledges and shall abide by the University’s prohibition on the use of 1099 independent contractors and owner/operator business entities wherein such individuals are not able to secure and maintain such insurance. The Contractor shall ensure that all classifications of laborers and construction mechanics performing Work on the Project job site are traditional employees of the Contractor or any Trade Contractor for any tier thereof, and that each is covered by such insurance.

(4) The Umbrella Excess Liability insurance must be consistent with and follow the form of the primary policies, except that Umbrella Excess Liability insurance shall not be required for the Medical Expense Limit.

(5) Builder’s Risk Insurance: The Contractor, at his sole expense, shall purchase and maintain property insurance upon the entire Project for the full replacement cost at the time of any loss. This insurance shall include “All Risk” coverage against physical loss or damage including the perils of Fire and Extended Coverage, Theft, Vandalism, and Malicious Mischief, Transit and Collapse. The Contractor will be responsible for any co-insurance penalties and/or deductibles.

(6) Professional Liability (Errors and Omissions) including tail-coverage for claims made after final completion.

4.05.2 Proof of Coverage

Certificates of Insurance or Declarations pages as may be requested by the University, as evidence of the insurance required by these Contract Documents, shall be submitted by the Contractor to the University. The Certificates of Insurance and Declarations shall state the scope of coverage and deductible, and list the University as an additional insured as required by Section 4.05.04 below. Any deductible shall be the Contractor's liability. The Declarations shall provide for no cancellation or modification of coverage without thirty (30) days prior written notice to the University. Acceptance of Certificates of Insurance or Declarations pages by the University shall not in any way limit the Contractor’s liabilities under the Contract Documents. The Contractor shall maintain required insurance for the entire duration of the Contract. In the event the Contractor does not comply with these insurance requirements, the University may, at its option, provide insurance coverage to protect the University; the cost of such insurance shall be deducted from the Contract Sum or otherwise paid by the Contractor. Renewal certifications shall be filed in a timely manner for all coverage until the Project is accepted as complete as requested by the University. Upon the University's request, the Contractor shall provide copies of the policies obtained from the insurers.
4.05.3 Subcontractor's Insurance

The Contractor shall either require Subcontractors to carry insurance as set forth in the CCIP Insurance Manual and the Subcontract, or the Contractor shall insure the activities of the Subcontractors in the amount, types and form of insurance required under by the Contract Documents. If the Contractor elects to have its Subcontractors purchase individual insurance policies, the Contractor shall cause its trade contracts and subcontracts to include a clause requiring that copies of any insurance policies which provide coverage to the Work shall be furnished to the University upon request. The Contractor shall supply the University with a list of all Subcontractors, including those enrolled in the CCIP coverage, and copies of the enrolled Subcontractors' certificates of insurance evidencing coverage, showing whether or not they have individual insurance policies and certifying that those subcontractors without individual insurance policies are insured by the Contractor.

4.05.4 Scope of Insurance Coverage

The Contractor's insurance as required by the Contract Documents (including subcontractors' insurance), by endorsement to the policies and the Certificates of Insurance, shall include the following and may be presented in the form of a rider attached to the Certificates of Insurance:

1. The Board of Governors of Wayne State University, the University, their officers, employees, representatives and agents including the Design Professional, shall be included as additional insured under the general liability, builder's risk and automobile liability policies for and relating to the Work to be performed by the Contractor and subcontractors. This shall apply to all claims, costs, injuries, or damages.

2. A Severability of Interest Clause stating that, “The term 'insured' is hereby used severally and not collectively, but the inclusion herein of more than one insured shall not operate to increase the limits of the insurer's or insurers' liability.”

3. A Cross Liability Clause stating that, “In the event of claims being made under any of the coverages of the policy or policies referred to herein by one or more insured hereunder for which another or other insured hereunder may be liable, then the policy or policies shall cover such insured or insured against whom a claim is made or may be made in the same manner as if separate policies had been issued to each insured hereunder. Nothing contained herein, however, shall operate to increase the insurer's limits of liability as set forth in the insuring agreements.”

4. The Board of Governors of Wayne State University, the University, their officers, employees, representatives and agents, shall not by reason of their inclusion as insured incur liability to the insurance carriers for payment of premiums for such insurance. However, the Board of Governors of Wayne State University may, in their sole discretion after receiving a notice of cancellation for nonpayment, elect to pay the premium due and deduct such payment from any sums due to the Contractor or recover the amount paid from the Contractor if the sums remaining are insufficient.

5. Coverage provided is primary and is not in excess of or contributing with any insurance or self-insurance maintained by the Board of Governors of Wayne State University, the University, their officers, employees, representatives and agents.

4.05.5 Miscellaneous Insurance Provisions

The form and substance of all insurance policies required to be obtained by the Contractor shall be subject to approval by the University. All such policies shall be issued by companies lawfully authorized to do business
in Michigan and be acceptable to the University. All property insurance policies to be obtained by the Contractor shall name the University as losspayee as its interest, from time to time, may appear.

The Contractor shall, by mutual agreement with the University and at the University’s cost, furnish any additional insurance as may be required by the University. The Contractor shall provide Certificates of Insurance evidencing such additional insurance.

Should the Project involve asbestos abatement, the Contractor or subcontractor, as appropriate, shall provide asbestos liability insurance.

The Contractor acknowledges that the University is self-insured and participates in the Michigan Universities Self-Insurance Corporation program and the Contractor agrees that the University is not required to provide or purchase any additional insurance with respect to this Project or the Work required by the Contractor for the Project.

4.05.6 Loss Adjustment

Any insured loss is to be adjusted with the Contractor and made payable jointly to the University and the Contractor. The Contractor shall cooperate with the University in a determination of the actual cash value or replacement value of any insured loss. Any deductible amount shall be the responsibility of the Contractor.

4.05.7 Compensation Distribution

The University upon the occurrence of an insured loss shall account for any money so received and shall distribute it in accordance with such agreement as the interested parties may reach. Claim payments received shall be distributed proportionately according to the actual percentages of losses to both. If after such loss no other special agreement is made, replacement of damaged work shall be covered by an appropriate contract change order. Any dispute shall be resolved by the University.

4.05.8 Waivers of Subrogation

The University and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other perils to the extent covered by property insurance obtained pursuant to this paragraph or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the University as fiduciary. The University or Contractor, as appropriate, shall require of the Design Professional, Design Professional’s consultants, separate Contractors if any, and any of their subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

4.06 Indemnification

4.06.1

To the fullest extent permitted by law, the Contractor shall hold harmless, defend, and indemnify the Board of Governors of Wayne State University, the University, and officers, employees, representatives and agents of
each of them, from and against any and all claims or losses arising out of or are alleged to be resulting from, or relating to (1) the failure of the Contractor to perform its obligations under the Contract or the performance of its obligation in a willful or negligent manner; (2) the inaccuracy of any representation or warranty by the Contractor given in accordance with or contained in the Contract Documents; and (3) any claim of damage or loss by any subcontractor, or supplier, or laborer against the University arising out of any alleged act or omission of the Contractor or any other subcontractor, or anyone directly or indirectly employed by the Contractor or any subcontractor.

4.06.2

To the fullest extent permitted by law, the Contractor shall be liable for and hereby agrees to defend, discharge, fully indemnify and hold the University harmless from and against any and all claims, demands, damages, liability, actions, causes of action, losses, judgments, costs and expenses of every nature (including investigation costs and/or expenses, settlement costs, and attorney fees and expenses incident thereto) sustained by or asserted against the University arising out of, resulting from, or attributable to the performance or nonperformance of any Work and/or obligation covered by the Contract or to be undertaken in connection with the construction of the Project contemplated by the Contract (collectively, "Claim"), including, but not limited to, any Claim for: (a) any personal or bodily injury, illness or disease, including death at any time resulting therefrom of any person, (including, but not limited to, employees of the University, the Contractor, any subcontractor, and any materialman and the general public); (b) any loss, damage or destruction of any property; (c) any loss or damage to the University's operations, arising out of, resulting from, or attributable in whole or in part to (i) any negligence or other act or omission of the Contractor, and any subcontractor, any materialman and/or any other person or any of the directors, officers, employees or agents of any of them or (ii) any defects in material or equipment furnished hereunder; (d) any payments allegedly owed to subcontractors, sub-subcontractors or materialmen; (e) any acts or omissions relative to conditions of safety and protection of persons on the Project site; and/or (f) any act or omission relative to the Contractor's breach of obligations and regarding non-discrimination as set forth in these General Conditions. The Contractor shall not be liable hereunder to indemnify the University against liability for damages arising out of bodily injury to persons or damage to property caused by or resulting from the sole negligence or willful misconduct of the University, its agents or employees. The Contractor, at its own cost and expense, shall take out and maintain at all times during the effective period of the Contract, contractual liability insurance insuring the performance by the Contractor of its contractual duties and obligations under this Article, which insurance shall name the University as additional insured and shall be in form and amount and from an insurance company satisfactory to the University. The Contractor's duty to fully indemnify the University shall not be limited in any way by the existence of this insurance coverage.

4.06.3

The Contractor shall also be liable for and hereby agrees to pay, reimburse, fully indemnify and hold the University harmless from and against all costs and expenses of every nature (including attorney fees and expenses incident thereto) incurred by the University in collecting the amounts due from the Contractor, or otherwise enforcing its rights, under the indemnifications described in this Article.

4.06.4

In claims against any person or entity indemnified under this Article made by an employee of the Contractor or a subcontractor, or indirectly employed by either of them, or anyone for whose acts either made by liable, the indemnification obligation under this Article shall not be limited by any limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a subcontractor under workers compensation laws, disability benefit laws, or other laws providing employee benefits.

4.06.5
The indemnification obligations under this Article shall not be limited by any assertion or finding that the person or entity indemnified is liable by reason of a non-delegable duty.

4.06.6

The Contractor shall hold harmless, defend, and indemnify the University from and against losses resulting from any claim of damage made by any separate Contractor of the University against the University arising out of any alleged acts or omissions of the Contractor, a subcontractor, anyone directly or indirectly employed by either the Contractor or subcontractor, or anyone for whose acts either the Contractor or subcontractor may be liable.

4.06.7

The Contractor shall hold harmless, defend and indemnify the Design Professional and the separate Contractors of the University from and against losses to the extent they arise from the negligent acts or omissions or willful misconduct of the Contractor, a subcontractor, anyone directly or indirectly employed by the Contractor or subcontractor, or anyone for whose acts the Contractor or subcontractor may be liable.

4.07 Occupancy by University Prior to Acceptance

The University may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the University and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a description of the area substantially complete to the Design Professional. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the University and Contractor or, if no agreement is reached, by decision of the Design Professional.

Immediately prior to such partial occupancy or use, the University together with the Contractor and Design Professional shall jointly observe and/or inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents. Likewise, partial occupancy or use of a portion or portions of the Work shall not alter, change or modify the requirements for Substantial or Final Completion within Contract Time.

4.08 Contract Time

4.08.1 Time of the Essence

All time limits specified in this Contract are of the essence of the Contract.

4.08.2 Starting and Completion Date
The University shall designate in the Notice to Proceed the starting date of the Contract on which the Contractor shall immediately begin and thereafter diligently prosecute the Work to completion. The Contractor agrees to complete the Work on the date specified for completion of the Contractor's performance in the Contract unless such time is adjusted, in writing, by change order issued by the University. The Contractor may complete the Work before the completion date if it will not interfere with the University or their other Contractors engaged in related or adjacent Work. The date of Substantial Completion shall be used as the commencement date of the guarantee.

4.08.3 Delay

Within ten (10) days from the commencement of a delay, Contractor shall submit to the University's Representative a written notice of the delay. Such notice of delay shall describe the nature and cause of the delay, provide a preliminary estimate of the impact of said delay on the construction schedule and provide a recovery plan to mitigate the delay. The Contractor's failure to give such notice to the University shall constitute a waiver by the Contractor of its ability to request an extension of time. In the case of a continuing cause of delay, only one claim shall be necessary. The giving of such notice shall not of itself establish the validity of the cause of delay or of the extension of the time for completion. Submission of reports and/or updates required at regularly scheduled meetings or as a part of a regularly submitted report shall not constitute such required notice.

The Contractor expressly agrees that delays to construction activities which do not affect the overall time of completion of the Work shall not entitle the Contractor to an extension of the Contract Time or provide a basis for additional cost or damages. No delay, obstruction, interference, hindrance, or disruption, from whatever source or cause in the progress of the Contractor's Work shall be a basis for an extension of time unless the delay, obstruction, interference, hindrance, or disruption is without the fault and not the responsibility of the Contractor and directly affects the overall completion of the Work as reflected in the Contractor's updated and accepted Project schedule.

Within fifteen (15) days from the submittal to the University of the notice of delay detailed in the previous paragraphs, Contractor shall submit to the University's Representative a request for an extension of time which shall include all documentation supporting the request. Such submittal shall include a detailed description of all changes in activity duration, logic, sequence, or otherwise in the Project schedule. The filing of such a request for an extension of time shall not of itself establish the validity of the cause of delay or of the extension of time for completion. Submission of construction reports and/or updates required by these General and Supplementary Conditions shall not constitute such a request.

4.08.4 Adjustment of Contract Time and Cost

If the Contractor is delayed, obstructed or hindered at any time in the progress of the Work by any act or neglect of the University or by any contractor employed by the University, or by changes ordered in the scope of the Work, or by fire, adverse weather conditions not reasonably anticipated, or any other causes beyond the control of the Contractor with the exception of labor disputes or strikes of the Contractor's or a Subcontractor's own personnel, then the duration set forth in the Master Project Schedule, and established for Substantial and Final Completion may be extended as agreed to by the University, Contractor and Design Professional. When such delays result in an agreement to adjust the Time of Completion, then the Contractor may also request, and the University may make a reasonable adjustment to the Contract Sum for Project costs directly attributable to the delay pursuant to Article 6.00, CHANGES IN THE WORK. It will be the Contractor's obligation to demonstrate to the complete satisfaction of the University, that the direct Project costs associated with such delays are justified, fair, and reasonable.
The University will not recognize labor disputes, strikes, work stoppages, picketing or boycotting by employees of or under the control or direction of the Contractor or its subcontractors, to be cause for extending the Construction Project Schedule or the Contract Time or adjusting the Contract Sum. The University may recognize labor disputes, strikes, work stoppages, picketing or boycotting that are not within the Contractor's or its subcontractors' control as cause for extending the Construction Project Schedule or Contract Time. Pursuant to section 9.01.1 such labor disputes, strikes, work stoppages, picketing or boycotts may constitute grounds for termination of the Contractor.

4.08.5 Contractor to Fully Prosecute Work

No extension of time will be granted unless the Contractor demonstrates to the satisfaction of the University that the Contractor has made every reasonable effort to complete all Work under the Contract not later than the date prescribed.

4.08.6 University's Adjustment of Contract Time

Even though the Contractor has no right to an extension of time for completion, the University may in the exercise of its sole discretion extend the time at the request of the Contractor if it determines it to be in the best interest of the University.

4.08.7 Adjustment of Contract Time and Cost Due to Reasons Beyond University Control

Should the University be prevented or enjoined from proceeding with Work either before or after the start of construction by reason of any litigation or other reason beyond its control, the Contractor may request an adjustment in the Time of Completion and/or Contract Sum by reason of said delay. The University may make a reasonable adjustment in the Time of Completion and/or Contract Sum for time and costs directly attributable to the delay. It will be the Contractor's obligation to demonstrate to the complete satisfaction of the University, that all Time of Completion and Contract Sum adjustments associated with such delays are justified, fair, and reasonable.

4.09 Progress Schedule

4.09.1

The Contractor shall prepare and submit to the University the Contractor's Construction Schedule utilizing the Critical Path Method within ten (10) days after starting date on the Notice to Proceed. It shall be the Contractor's responsibility to use its best efforts and to act with due diligence to maintain the progress of the Work in accordance with the schedule. The time for completion may be extended only by a written Change Order executed by the University and the Contractor. The work activities making up the schedule shall be of sufficient detail to assure that adequate planning has been done for proper execution of the Work and such that, in the sole judgment of the University, it provides an appropriate basis for monitoring and evaluating the progress of the Work. The Construction Schedule shall include the time periods required for utility and service interruptions, including compliance with the notice periods stated in the Utility Disturbance and Disruption Request. The Contractor shall also submit a separate progress schedule listing all submittals required under the Contract and the date by which each submittal will be submitted allowing 10 days for the Design Professional's review ("submittal schedule").
Float, slack time, or contingency within the schedule at the activity level and total float within the overall schedule, is not for the exclusive use of either the University or the Contractor, but is jointly owned by both and is a resource available to and shared by both parties as needed to meet Contract milestones and the Contract completion date.

4.09.5

The Contractor shall not sequester shared float through such strategies as extending activity duration estimates to consume available float, using preferential logic, or using extensive crew/resource sequencing, etc. Since float time within the construction schedule is jointly owned, it is acknowledged that University caused delays on the Project may be offset by University caused time savings (i.e., critical path submittals returned in less time than allowed by the Contract, approval of substitution requests which result in a savings of time to the Contractor, etc.). In such an event, the Contractor shall not be entitled to receive a time extension until all University caused time savings are exceeded and the Contract completion date is also exceeded.

4.09.6

Regardless of which schedule method the Contractor elects to use in formulating the Contractor's Construction Schedule, an updated construction schedule shall be submitted to the University five (5) days prior to the submittal of the Contractor's monthly payment request. The submission of the updated construction schedule satisfying the requirements of this Article, accurately reflects the status of the Work, and incorporates all changes into the schedule, including actual dates, shall be a condition precedent to the processing of monthly payment applications. Updated schedules shall also be submitted at such other times as the University may direct. Upon approval of a change order or issuance of a direction to proceed with a change, the approved change shall be reflected in the next schedule update submitted by the Contractor.

4.09.7

If completion of any part of the Work, the delivery of equipment or materials, or issuance of the Contractor submittals is behind the updated Construction Schedule and will cause the end date of the Work to be later than the Contract completion date, the Contractor shall submit in writing a plan acceptable to the University for completing the Work on or before the current Contract completion date.

4.09.8

No time extensions shall be granted unless the delay can be clearly demonstrated by the Contractor on the basis of the updated Construction Schedule current as of the month the change is issued or the delay occurred, and the delay cannot be mitigated, offset, or eliminated through such actions as revising the intended sequence of Work or other means.

4.09.9

As a condition precedent to the release of retained funds, the Contractor shall, after completion of the Work has been achieved, submit a final Construction Schedule which accurately reflects the manner in which the Project was constructed and includes actual start and completion dates for all Work activities on the Project schedule together with a full and unconditional waiver and release of claims for payment in a form acceptable to the University.

4.10 Coordination With Other Work
The University reserves the right to do other Work in connection with the Project or adjacent thereto and the Contractor shall at all times conduct the Work so as to impose no hardship on the University or others engaged in the University’s Work nor to cause any unreasonable delay or hindrance thereto.

Where two or more Contractors are employed on related or adjacent work, each shall conduct their operation in such a manner as not to cause delay or additional expense to the other.

The Contractor shall be responsible to others engaged in the related or adjacent work for all damage to Work, to persons and to property, and for loss caused by failure to complete the Work within the specified time for completion. The Contractor shall coordinate its Work with the Work of others so that no discrepancies shall result in the Project.

4.11 As-built Drawings Reflecting Actual Construction

During the course of construction, the Contractor shall maintain drawings kept up each day to show the Project as it is actually constructed. Every sheet of the plans and specifications which differs from the actual construction shall be marked and sheets so changed shall be noted on the title sheets of the plans and specifications. All change orders shall be shown by reference to sketch drawings, and any supplementary drawings or change order drawings shall be included. The Contractor shall review the “As-built” drawings with the University at least once a month to demonstrate that all changes that have occurred are being fully and accurately recorded. The altered Contract drawings shall be sufficiently detailed so that future Work on the Project or in adjacent areas may be conducted with a minimum of difficulty. Prior to the completion of the Project, and prior to release of the final retention payments, the “As-built” drawings and specifications shall be transmitted in hard copy and electronic format as directed by the University to the University or the Design Professional for further review. A copy of the transmittal shall be sent to the University and included in the formal Close-out documents.

4.12 Cleanup of Project and Site

The Contractor shall, on a daily basis, keep the premises and surrounding area free from accumulation of waste materials, combustibles, or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove from and about the Project waste materials, combustibles, rubbish, the Contractor’s tools, construction equipment, machinery and surplus materials.

If the Contractor fails to clean up as provided in the Contract Documents, the University may do so and the cost thereof shall be charged to the Contractor. Any additional cleaning requirements are as stated in the Supplementary General Conditions.

Upon completion of the Work, the Contractor shall promptly remove from the premises construction equipment and any waste materials not previously disposed of, leaving the premises thoroughly clean and ready for occupancy.

When two or more Contractors are engaged in work at or near the site, each shall be responsible for cleanup and removal of its own rubbish, equipment, and any waste materials not previously disposed.

In the event the Contractor does not maintain the Project or the site clear of debris and rubbish in a manner acceptable to the Design Professional or University, the University may, at its option, cause the Project or site to be properly cleaned and may withhold the incurred expense from payments due the Contractor or otherwise receive reimbursement from the Contractor.

4.13 [Not used]
4.14 Project Sign, Advertising

If included as a requirement in the project documents, Contractor shall furnish and install a project sign as designed by the Design Professional and accepted by the University as part of the Work under the Contract. As a minimum, the sign shall be four feet by eight feet, made from three-quarter inch plywood. The sign shall identify the Project name, the University including the individual members of the Board of Governors, the Design Professional, and the Contractor. No advertising is permitted on the Project or site without written permission from the University. If the Project is funded by a State of Michigan capital appropriation, the Contractor shall also provide a project sign which satisfies the requirements of the State of Michigan as stipulated in the Department of Technology Management and Budget’s Major Project Design Manual, current edition.
5.00 INTERPRETATION OF AND ADHERENCE TO CONTRACT REQUIREMENTS

5.01 Interpretation of Contract Requirements

5.01.1 Conflicts

In the event of conflict in the Contract Documents, the priorities stated below shall govern:

(1) Addenda shall govern over all other Contract Documents and subsequent addenda shall govern over prior addenda only to the extent that they modify prior addenda. Such addenda shall only govern the scope of Work, Contract Sum, and Time of Completion, and shall not be deemed to amend the Contract, General Conditions of Construction, or Supplementary General Conditions of Construction.

(2) In case of conflict between plans and specifications, the specifications take precedence over drawings for the specific type or quality of materials or the quality of installation; the drawings take precedence over the specifications with regard to quantities, locations or detail of installation.

(3) Conflicts within the plans:

(a) Schedules, when identified as such, shall govern over all other portions of the plans.

(b) Specific notes shall govern over all other notes and all other portions of the plans except the schedules described in Article 5.01.1, above.

(c) Larger scale drawings shall govern over smaller scale drawings.

(d) Figured or numerical dimensions shall govern over dimensions obtained by scaling. Scaling the drawings is prohibited.

(4) Conflicts within the specifications:

“General Conditions for Construction” shall govern over all sections of the specifications except for specific modifications thereto that may be stated in Supplementary General Conditions or addenda. No other section of the specifications shall modify the General Conditions for Construction.

(5) In the event provisions of codes, safety orders, Contract Documents, referenced manufacturer's specifications or industry standards are in conflict, the more restrictive or higher quality shall govern.

5.01.2 Omissions

If the Contract Documents are not complete as to any minor detail of a required construction system or with regard to the manner of combining or installing of parts, materials, or equipment, but there exists an accepted trade standard for good and skillful construction, such detail shall be deemed to be an implied requirement of the Contract Documents in accordance with such standard. “Minor Detail” shall include the concept of substantially identical components, where the price of each such component is small even though the aggregate cost or importance is substantial, and shall include a single component which is incidental, even though its cost or importance may be substantial.

The quality and quantity of the parts or material so supplied shall conform to trade standards and be compatible with the type, composition, strength, size, and profile of the parts of materials otherwise set forth in the Contract Documents.
5.01.3 Miscellaneous

Portions of the Work which can be best illustrated by the Drawings may not be included in the Specifications and portions best described by the Specifications may not be depicted on the Drawings.

If an item or system is either shown or specified, all material and equipment normally furnished with such items and needed to make a complete operating installation shall be provided whether mentioned or not, even though such materials and equipment are not shown on the drawings or described in the specifications, omitting only such parts as are specifically excepted. Words and abbreviations which have well-known technical or trade meanings are used in the Contract Documents in accordance with such recognized meanings.

The General Conditions and Supplementary General Conditions are a part of each and every section of the Specifications.

All drawings, Project Plans and Specifications, renderings and models or other documentation, and copies thereof, furnished by the University or any agent, employee or consultant of the University, or Design Professional, are and shall remain the property of the University. They are to be used only with respect to this Project and are not to be used on any other project.

5.01.4 Interpreter of Documents

The University's Representative shall be the Interpreter, with the advice of the Design Professional, of the Contract Documents and shall be the judge of the performance of the Contractor and subcontractors. Subject to the provisions Article 7, claims, disputes and other matters of controversy relating to the Contract Documents or the Work shall be decided by the University's Representative. The decision of the University's Representative shall be final.

5.02 Issuance of Interpretations, Clarifications, Additional Instructions (Requests for Information)

Should the Contractor discover any conflicts, omissions, or errors in the Contract or have any question concerning interpretation or clarification of the Contract Documents, the Contractor shall request in writing an interpretation, clarification, or additional detailed instructions before proceeding with the Work affected. The written request shall be given to the Design Professional and University within 5 days of discovery.

The Design Professional, with review as required by the University, shall, within 10 days or other reasonable time, issue in writing the interpretation, clarification, or additional detailed instructions requested. In the event that the Contractor believes that the progress of the Work is being delayed by a Request for Information or a response to a Request for Information, Contractor shall comply with the procedures stated in section 4.08 of these General Conditions for an extension of time.

Should the Contractor proceed with the Work affected before receipt of the interpretation, clarification, or instructions from the Design Professional, the Contractor shall replace or adjust any Work not in conformance therewith and shall be responsible for any resultant damage or added cost.

Should any interpretation, clarification, or additional detailed instructions, in the opinion of the Contractor, constitute Work beyond the scope of the Contract, the Contractor must submit written notice thereof to the Design Professional and University within five (5) calendar days following receipt of such interpretation, clarification, or additional detailed instructions and in any event prior to commencement of Work thereon. The Contractor shall submit an explanation of how the interpretation, clarification, or additional detailed instruction constitutes work beyond the scope of the Contract, along with a detailed cost breakdown and an explanation.
of any delay impacts. The Design Professional shall consider such notice and make a recommendation to
the University. If, in the judgment of the University, the notice is justified, the interpretation, clarification or
additional detailed instructions shall either be revised or the extra work authorized by Contract change order or
by field instruction with a change order to follow. If the University decides that the request is not justified and
the Contractor does not agree, the Contractor shall nevertheless perform such Work upon receipt from the
University of written authorization to do so. In such case, the Contractor shall have the right to have the Claim
later determined only pursuant to the requirements of this Contract. However, any such Claim for additional
compensation because of such interpretation, clarification, or additional detailed instruction is waived, unless
the Contractor gives written notice to the Design Professional and University within five (5) calendar days as
specified above.

5.03 Product and Reference Standards

5.03.1 Product Designation

When descriptive catalog designations, including the manufacturer’s name, product brand name, or model
number are referred to in the Contract Documents, such designations shall be considered as being those
found in industry publications of current issue at the date of Contract execution.

5.03.2 Reference Standards

When standards of the federal government, trade societies, or trade associations are referred to in the
Contract Documents by specific date of issue, these shall be considered a part of this Contract. When such
references do not bear a date of issue, the current and most recently published edition at the date of Contract
execution shall be considered a part of this Contract.

5.04 Shop Drawings, Samples, Alternatives or Equals, Substitutions

5.04.1 Submittal Procedure

Shop drawings include drawings, diagrams, illustrations, schedules, performance charts, brochures and
catalogs and other data prepared by the Contractor or any subcontractor, manufacturer, supplier or distributor,
and which illustrate some portion of the Work. In accordance with the submittal schedule, the Contractor shall
promptly review and approve all shop drawings and then submit the shop drawings to the Design Professional
together with samples as required by the Contract Documents and shall also submit any offers of alternatives
or substitutions. The Design Professional shall have 10 days to respond with an acknowledgement of
approval, clearly defined exceptions, or rejections. Rejections shall be cause for re-submission and no
contract time adjustments will be granted for such requirements. At least six copies of brochures, one copy of
shop drawings and one PDF digital file of shop drawings shall be submitted as well as additional copies as
required by Design Professional. All such submittals shall be sent to Design Professional at the address
given in the instructions to the Contractor at the job start meeting. A letter shall accompany the submitted
items which shall contain a list of all matters submitted and shall identify all deviations shown in the shop
drawings and samples from the requirements of the Contract Documents. Failure by the Contractor to identify
all deviations may render void any action taken by the Design Professional on the materials submitted.
Whether to void such action shall be in the discretion of the Design Professional. The letter and all items
accompanying it shall be fully identified as to project name and location, the Contractor’s name, and the
University’s Project number. By submitting the approved shop drawings and samples, the Contractor
warrants and represents that the data contained therein have been verified with conditions as they actually
exist and that the shop drawings and samples have been checked and coordinated with the Contract
Documents.

5.04.2 Samples
Samples are physical examples furnished by the Contractor to illustrate materials, equipment, color, texture, or worker ship, and to establish standards by which the Work will be judged. Unless otherwise approved, at least two samples will be submitted for each item requiring samples to be submitted.

The Work shall be in accordance with the samples and reviewed by Design Professional. Samples shall be removed by the Contractor from the site when directed. Samples not removed by the Contractor, will become the property of the University and will be removed or disposed of by the University at the Contractor’s expense.

5.04.2.1 Mock-ups as may be required by the Contract Documents

Mock-ups, models or temporary construction as may be required by the University shall be removed and disposed of by the Contractor at Contractor's sole cost and expense from the site when directed.

5.04.3

5.04.3 Substitutions

For convenience in designation on the plans or in the specifications, certain materials or equipment may be designated by a brand or trade name or the name of the manufacturer together with catalog designation or other identifying information, hereinafter referred to generically as “designated by brand name.” Alternative material or equipment which is of equal quality and of the required characteristics for the purpose intended may be proposed for use provided the Contractor complies with the requirements stated in this section. If the Contractor proposes a product that is of lesser or greater quality or performance than the specified material or equipment, Contractor must both comply with the provisions of section 5.04 and submit any cost impact. The Contractor shall submit its proposal to University and the Design Professional for an alternative in writing within the time limit designated in the Contract, or if not so designated, then within a period which will cause no delay in the Work. By submitting a substitute, the Contractor waives any rights to claim a delay due to the processing of this substitution.

The Contractor may offer a substitution of a specified or indicated item if it presents complete information concerning the substitution and the benefits thereof to the University by reason of lower cost or improved performance, or both, over the specified or indicated item. However, such submission of a proposed substitution does not relieve the Contractor from its obligations under the Contract. In proposing a substitution, the Contractor warrants that the substitution is, at a minimum, equivalent in performance to the specified or indicated item. A substitution shall not be effective unless accepted in writing by the University.

Any additional costs and changes to the Work (including, but not limited to the Work of other Contractors and additional design costs which may be affected thereby) which may result from the proposed substitution shall be disclosed at the time the substitution is proposed to the University. Changes to the Work and any additional costs therefrom shall be the sole responsibility of the Contractor and shall not increase the Contract Sum.

The Contractor’s substitution proposals shall include written descriptions of the items to be substituted (including drawings and/or specifications) and referenced information of the proposed substitution. The Design Professional and University's Representative's signature on this proposal is required for acceptance. Shop Drawings will not be considered a substitution proposal pursuant to this section. Verbal approvals or approved Shop Drawings will not be considered as acceptance of proposed substitutions.

5.05 Quality of Materials, Articles and Equipment
Materials, articles and equipment furnished by the Contractor for incorporation into the Work shall be new unless otherwise specified in the Contract Documents. When the Contract requires that materials, articles or equipment be furnished, but the quality or kind thereof is not specified, the Contractor shall furnish materials, articles or equipment at least equal to the kind or quality or both of materials, articles or equipment which are specified.

5.06 Testing Materials, Articles, Equipment and Work

Materials, articles, equipment or other Work requiring tests are specified in the Contract Documents. Materials, articles and equipment requiring tests shall be delivered to the site in ample time before intended use to allow for testing and shall not be used prior to testing and receipt of written approval. The Contractor shall be solely responsible for notifying the University where and when materials, articles, equipment and Work are ready for testing. Should any such materials, articles, equipment or Work be covered without testing and approval, if required, they shall be uncovered at the Contractor’s expense. The University has the right to order the testing of any other materials, articles, equipment or Work at any time during the progress of the Work. Unless otherwise directed, all samples for testing shall be taken by the University from materials, articles or equipment to be used on the project or from Work performed. All tests will be under the supervision of, and at locations convenient to, the University. The University shall select the laboratories for all tests. Decisions regarding the adequacy of materials, articles, equipment or Work shall be issued to the University in writing. The University may decide to take further samples and tests, and if the results show that the Work was not defective, the University shall bear the costs of such samples and tests. In the event the results of such additional samples and tests show that the Work was defective, the Contractor shall bear the cost of such samples and tests. Samples that are of value after testing shall remain the property of the Contractor. All retesting and reinspection costs may be back charged to the Contractor by the University.

5.07 Rejection

Should any portion of the Work or any materials, articles or equipment delivered to the Project fail to comply with the requirements of the Contract Documents, such Work, materials, articles or equipment shall be rejected in writing and the Contractor shall immediately correct the deficiency to the satisfaction of the Design Professional and the University at no additional expense to the University. Any Work, materials, articles or equipment which is rejected shall immediately be removed from the premises at the expense of the Contractor. The University may retain one and one-fourth times the cost of the rejected materials, articles, equipment, and Work from any payments due the Contractor until such time as the deficiency is made acceptable to the Design Professional and University.

5.08 Responsibility for Quality

The testing and inspection provided by the University shall not relieve the Contractor of its responsibility for the quality of materials and workmanship provided by the Contractor, and the Contractor shall make good all defective Work discovered during or after completion of the Project.
6.00 CHANGES IN THE WORK

6.01 Change Orders

6.01.1 Generally

The University reserves the right to issue written orders whether through a formal Change Order or Preliminary Project Cost and Schedule Impact Report, directing changes in the Contract at any time prior to the acceptance of the Project without voiding the Contract, and Contractor shall promptly comply with such order or direction. The Contractor may request changes in the Work, but shall not act on the changes until approved in writing by the University. Any change made without authority in writing from the University shall be the responsibility of the Contractor.

Any such changes in the Work that have a cost impact shall only be authorized by Change Orders approved by the University. No action, conduct, omission, prior failure or course of dealing by the University shall act to waive, modify, change or alter the requirement that Change Orders must be in writing and signed by the University and Contractor and that such written Change Orders are the exclusive method for changing or altering the Contract Sum or Contract Time. The University and Contractor understand and agree that the Contract Sum and Contract Time cannot be changed by implication, oral agreements, actions, inactions, course of conduct or Preliminary Project Cost and Schedule Impact Report.

On the basis set forth herein, the Contract Sum may be adjusted for any Change Order requiring a different quantity or quality of labor, materials or equipment from that originally required, and the partial payments to the Contractor, set forth in section 8.01, may be adjusted to reflect the change. Whenever the necessity for a change arises, and when so ordered by the University in writing, the Contractor shall take all necessary steps to mitigate the effect of the ultimate change on the other Work in the area of the change. Changed Work shall be performed in accordance with the original Contract requirements except as modified by the Change Order. Except as herein provided, the Contractor shall have no claim for any other compensation including lost productivity or increased overhead expenses due to changes in the Work.

6.01.2 Proposed Change Orders

The Design Professional, with approval of the University, shall issue to the Contractor a cost request Bulletin for a proposed change order describing the intended change and shall require the Contractor to indicate thereon a proposed amount to be added to or subtracted from the Contract Sum due to the change supported by a detailed estimate of cost. Upon request by the University, the Contractor shall permit inspection of the original Contract estimate, Trade Contract agreements, or purchase orders relating to the change. Any request for adjustment in Contract Time which is directly attributable to the changed Work shall be included with substantiating detailed explanation by the Contractor in its response to the cost request bulletin. Failure by Contractor to request adjustment of Contract Time on the response to the cost request Bulletin shall waive any right to subsequently claim an adjustment of the Contract Time based on the changed Work. The Contractor shall submit the response to the cost request Bulletin with detailed estimates and any time extension request thereon to the Design Professional within ten (10) days after issuance of the cost request Bulletin. Upon its submission, the Design Professional will review it and advise the University who will make the decision regarding the request. The University retains sole discretion to accept, reject, or modify the proposed change. If the Contractor fails to submit the response within the required ten (10) days, and the Contractor has not obtained the Design Professional's and the University's permission for a delay in submission, the University may order the Contractor in writing to begin the Work immediately, and the Contract Sum shall be adjusted in accordance with the University's estimate of cost. In that event, the Contractor, within fifteen days following completion of the changed Work, may present information to the University that the University's estimate was in error; the University, in its sole discretion, may adjust the Contract Sum. The Contractor must keep and submit to the University time and materials records verified by
the University to substantiate its costs. The University may require the Contractor to proceed immediately with the changed Work in accordance with section 6.01.4, “Failure to Agree as to Cost” or section 6.02 “Emergency Changes.”

When the University and the Contractor agree on the amount to be added to or deducted from the Contract Sum and the time to be added to or deducted from the Contract Time and a Contract Change Order is signed by the University and the Contractor, the Contractor shall proceed with the changed Work. If agreement is reached as to the adjustment in compensation for the performance of changed Work but agreement is not reached as to the time adjustment for such Work, the Contractor shall proceed with the Work at the agreed price, reserving the right to further pursue its Claim for a time adjustment. Any costs incurred to acquire information relative to a proposed Change Order shall not be borne by the University.

6.01.3 Allowable Costs Upon Change Orders

The identification of and manner in which costs will be allowed because of changed Work shall be computed as described by this section.

6.01.3.1 Labor

Costs are allowed for the actual payroll cost to the Contractor for direct labor, engineering or technical services directly required for the performance of the changed Work, (but not site management such as field office estimating, clerical, project engineering, management or supervision) including payments, assessments, or benefits required by lawful labor union collective bargaining agreements, compensation insurance payments, contributions made to the State pursuant to the Unemployment Insurance Code, and for taxes paid to the federal government required by the Social Security Act of 1935, as amended, unless the time of completion adjustments affect the general condition inclusion of the Contract Sum.

No labor cost will be recognized at a rate that deviates from the prevailing wages in the locality of Wayne County, Michigan as provided by the University at the time the Work is performed, or of wage and benefit rates associated with trade union collective bargaining agreements prevailing at the time of the change, and the use of a classification which would increase the labor cost may not be permitted unless the Contractor established to the satisfaction of the University the necessity for payment at a higher rate.

6.01.3.2 Materials

Costs are allowed for the actual cost to the Contractor for the materials directly required for the performance of the changed Work. Such cost of materials may include the costs of transportation, sales tax, and delivery if necessarily incurred. However, overhead costs shall not be included. If a trade discount by the actual supplier is available to the Contractor, it shall be credited to the University. If the materials are obtained from a supply or source owned wholly or in part by the Contractor, payment therefor will not exceed the current wholesale price for such materials.

If, in the opinion of the University, the cost of materials is excessive, or if the Contractor fails to furnish satisfactory evidence of the cost from the actual suppliers thereof, then in either case the cost of the materials shall be deemed to be the lowest wholesale price at which similar materials are available in the quantities required at the time they were needed.

6.01.3.3 Equipment

Costs are allowed for the actual cost to the Contractor for the use of equipment directly required in the performance of the changed Work except that no payment will be made for time while equipment is inoperative due to breakdowns or for non-working days. The total rental cost shall not exceed seventy-five
percent (75%) of the market value of the rented equipment. The rental time shall include the time required to move the equipment to the Project site from the nearest available source for rental of such equipment, and to return it to the source. If such equipment is not moved by its own power, then loading and transportation costs will be paid. However, neither moving time nor loading and transportation costs will be paid if the equipment is used on the Project in any other way than upon the changed Work. Individual pieces of equipment having a replacement value of $500.00 or less shall be considered to be tools or small equipment, and no payment therefor will be made.

For equipment owned or furnished by the Contractor, no cost therefor shall be recognized in excess of the rental rates established by distributors or equipment rental agencies in the locality where the Work is performed. Blue Book rates shall not be used for any purpose.

The amount to be paid to the Contractor for the use of equipment as set forth above shall constitute full compensation to the Contractor for the cost of fuel, power, oil, lubrication, supplies, small tools, small equipment, necessary attachments, repairs and maintenance of any kind, depreciation, storage, insurance, labor (except for equipment operators who shall be paid for as provided in Article 6.01.3.1) and any and all costs to the Contractor incidental to the use of such equipment.

6.01.3.4 Change Order Mark-up Allowance

For Change Order scope whose cost is derived according to the Cost of Work plus a Fee as defined in 6.01.3.1 through 6.01.3.3, the mark-up allowance shall be as defined in the Contract. Lump-sum conditions shall include the mark-up allowance. When agreement as to cost cannot be reached, the Contractor shall execute the Work according to time and materials with the Contractor and University acknowledging such costs by signature on a daily basis, and as set forth below.

6.01.3.5 Credit for Deleted Work

For proposed change orders which involve both added and deleted Work, the Contractor shall separately estimate the cost of the added Work before mark-ups, and separately estimate the cost of the deleted Work before allowance of a credit. If the difference between the costs results in an increase to the Contract Sum, the mark-up for added Work shall be applied to the difference, and if the difference in the costs results in a decrease, then the mark-up for deleted Work shall be applied to the difference.

6.01.3.6 Market Values

Cost for added Work shall be no more than market values prevailing at the time of the change, unless the Contractor can establish to the satisfaction of the University that it investigated all possible means of obtaining Work at prevailing market values and that the excess cost could not be avoided.

When a change order deletes Work from the Contract, the computation of the cost thereof shall be the values which prevailed at the time bids for the Work were opened or the Contract Sum established.

6.01.4 Failure to Agree as to Cost

6.01.4.1 For Added Work

Notwithstanding the failure of the University and the Contractor to agree as to the cost of the proposed Change Order, the Contractor, upon written order from the University, shall proceed immediately with the changed Work. A Preliminary Project Cost and Schedule Impact Report or letter signed by the University shall be used for this written order. At the start of each day's Work on the change, the Contractor shall notify the University in writing as to the size of the labor force to be used for the changed Work and its location.
Failure to so notify may result in the non-acceptance of the costs for that day. At the completion of each day's Work, the Contractor shall furnish to the University a detailed summary of all labor, materials, and equipment employed in the changed Work. The University will compare his/her records with Contractor's daily summary and may make any necessary adjustments to the summary. After the University and the Contractor agree upon and sign the daily summary, the summary shall become the basis for determining costs for the additional Work. The sum of these costs when added to an appropriate mark-up will constitute the payment for the changed Work. Subsequent adjustments, however, may be made based on later audits by the University. When changed Work is performed at locations away from the job site, the Contractor shall furnish in lieu of the daily summary, a summary submitted at the completion of the Work containing a detailed statement of labor, material, and equipment used in the Work. This latter summary shall be signed by the Contractor who shall certify thereon that the information is true.

The Contractor shall maintain and furnish on demand of the University itemized statements of cost from all vendors and subcontractors who perform changed Work or furnish materials and equipment for such Work. All statements must be signed by the vendors and the subcontractors.

6.01.4.2 For Deleted Work

When a proposed Change Order contains a deletion of any Work, and the University and the Contractor are unable to agree upon the cost thereof, the University’s estimate shall be deducted from the Contract Sum and may be withheld from any payment due the Contractor until the Contractor presents adequate substantial information to the University that the University’s estimate was in error. The amount to be deducted shall be the actual costs to the Contractor for labor, materials, and equipment which would have been used on the deleted Work together with an amount for mark-up as defined in the Contract Documents.

6.01.5 Allowable Time Extensions

For any change in the Work, the Contractor shall only be entitled to such adjustments in Contract Time due solely to performance of the changed Work. The procedure for obtaining an extension of time is set forth in Section 4.08 of these General Conditions. No extension of time shall be granted for a change in the Work unless the Contractor demonstrates to the satisfaction of the University that the Work is on the critical path and submits an updated Critical Path Method schedule showing that an extension of time is required and that the Contractor is making, or has made, every reasonable effort to guarantee completion of the additional Work called for by the change within the time originally allotted for the Contract. Failure by the Contractor to make the required submission or showing constitutes a waiver of any possible adjustment in Contract Time.

Any adjustment in Contract time shall specify the exact impact on the date of Substantial Completion and Final Completion.

6.02 Emergency Changes

Changes in the Work made necessary due to unforeseen site conditions, discovery of errors in plans or specifications requiring immediate clarification in order to avoid a serious Work stoppage, changes of a kind where the extent cannot be determined until completed, or under any circumstances whatsoever when deemed necessary by the University are kinds of emergency changes which may be authorized by the University in writing to the Contractor. The Contractor shall commence performance of the emergency change immediately upon receipt of Preliminary Project Cost and Schedule Impact Report issued by the University.

If agreement is reached as to compensation adjustment for the purpose of any emergency change, then compensation will be as provided in this section relating to ordinary changes. If agreement is not reached as to compensation at the time of commencing the emergency change, then compensation will be as provided in
section 6.01.4, that is, time and materials records and summaries shall be witnessed and maintained until either a lump sum payment is agreed upon, or the changed Work is completed.

**6.03 Preliminary Project Cost and Schedule Impact Report**

The Contractor shall perform Work as directed by the University through a Preliminary Project Cost and Schedule Impact Report. The cost of the changed Work is to be determined as stated in the Preliminary Project Cost and Schedule Impact Report or pursuant to section 6.01.4.
7.00 CLAIMS AND DISPUTES

7.01 Policy of Cooperation

The parties shall endeavor to resolve all of their claims and disputes amicably and informally through open communication and discussion of all issues relating to the Project. To the greatest extent possible, the parties shall avoid invoking the formal dispute resolution procedures contained in the Contract Documents.

7.02 Recommendation of Design Professional

Claims, including those alleging an error or omission by the Design Professional, must be referred initially to the Design Professional for action as provided in paragraph 7.09 as an express condition precedent to proceeding further in resolving any claim.

7.03 Time Limits on Claims

Claims must be made within 5 days after occurrence of the event giving rise to such Claim or within 5 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Claims must be made by written notice. An additional Claim made after the initial Claim has been resolved by Change Order will not be valid.

7.04 Continuing Contract Performance

Pending final resolution of a Claim, unless otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract and the University shall continue to make payments in accordance with the Contract Documents subject to the University's rights relative to payments, withholding of payments, termination, or all other rights afforded it in the Contract Documents.

7.05 Claims for Concealed or Unknown Conditions

If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then written notice by the observing party shall be given to the other party promptly before conditions are disturbed and in no event later than 48 hours after first observance of the conditions. The Design Professional will promptly investigate such conditions and, if the conditions differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, the Design Professional will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Design Professional determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Design Professional shall so notify the University and Contractor in writing, stating the reasons. Claims by either party in opposition to such determination must be made within 10 days after the Design Professional has issued such determination. If the University and Contractor cannot agree on an adjustment in the Contract Sum or Contract Time, the adjustment shall be referred to the Design Professional for initial determination, subject to further proceedings pursuant to Paragraph 7.09.

7.06 Claims for Additional Cost

Any Claim by the Contractor for an increase in the Contract Sum shall be submitted in writing as required by the Contract Documents before proceeding to execute the Work. If the Contractor believes additional
cost is involved for reasons including but not limited to (1) a written interpretation from the Design Professional, (2) an order by the University to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the Design Professional, (4) failure of payment by the University, (5) termination of the Contract by the University, (6) University’s suspension or (7) changes in the scope of Work, the Contractor's claim shall be filed in strict accordance with the procedure established herein.

7.07 Claims for Additional Time

Any Claim by Contractor for an increase in the Contract Time shall be submitted in writing as required by the Contract Documents. The Contractor’s Claim shall include an estimate of the probable effect of delay on progress of the Work. In the case of a continuing delay only one Claim is necessary.

If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time and could not have been reasonably anticipated, and that weather conditions had an adverse effect on the scheduled construction.

7.08 Injury or Damage to Person or Property

If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, of any of the other party’s employees or agents, or of others for whose acts such party is legally liable, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 5 days after first observance. The notice shall provide sufficient detail to enable the other party to investigate the matter. If a Claim for additional cost or time related to this Claim is to be asserted, it shall be filed as provided in the Contract Documents.

7.09 Resolution of Claims and Disputes

7.09.1 Review by Design Professional

Design Professional will review all Claims and take one or more of the following preliminary actions within 10 days of receipt of a Claim: (1) request additional supporting data from the Claimant, (2) submit a schedule to the parties indicating when the Design Professional expects take action, (3) reject the Claim in whole or in part, stating reasons for rejection, (4) recommend approval of the Claim by the other party or (5) suggest a compromise. The Design Professional may also, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim.

If a Claim has been resolved, the Design Professional will prepare or obtain appropriate documentation. If a Claim has not been resolved, the party making the Claim shall, within 10 days after the Design Professional’s preliminary response, take one or more of the following actions: (1) submit additional supporting data requested by the Design Professional, (2) modify the initial Claim or (3) notify the Design Professional that the initial Claim stands.

If a Claim has not been resolved after consideration of the foregoing and of further evidence presented by the parties or requested by the Design Professional, the Design Professional will notify the parties in writing that the Design Professional’s opinion will be rendered within 5 days. Upon expiration of such time period, the Design Professional will render to the parties the Design Professional’s determination relative to the Claim, including any change in the Contract Sum or Contract Time or both. If there is a surety and there appears to be a possibility of a Contractor’s default, the Design Professional may, but is not obligated to, notify the surety and request the surety’s assistance in resolving the controversy. The
determination by the Design Professional shall be subject to the review and approval of the Associate Vice President of Facilities Planning and Management at Wayne State University.

7.09.2 Review by Associate Vice President of Facilities Planning and Management

The determination by the Design Professional shall be subject to the review and approval of the Associate Vice President of Facilities Planning and Management at Wayne State University who may request additional information from the Claimant for review and consideration. The Associate Vice President of Facilities Planning and Management may issue a schedule for further discussions, review or decision. Upon decision by the Associate Vice President of Facilities Planning and Management, if the Claimant seeks further review, the matter shall be submitted to the Vice-President of Finance and Business Operations.

7.09.3 Review Vice-President of Finance and Business Operations

If the determination by the Design Professional and the decision of the Associate Vice President does not resolve the Claim, the Claimant may appeal to the Vice President of Finance and Business Operations who shall review such determination and the supporting information submitted by the parties for the purpose of upholding, modifying, or rejecting the determination. The Vice President of Finance and Business Operations shall render a decision within forty-five days of the completion of any submissions by the parties. The decision of the Vice President of Finance and Business Operations is final unless it is challenged by either party by filing a lawsuit in the Court of Claims of the State of Michigan within one year of the issuance of the decision.

7.09.4 Jurisdiction

Sole and exclusive jurisdiction over all claims, disputes, and other matters in question arising out of or relating to this Contract or the breach thereof, shall rest in the Court of Claims of the State of Michigan. No provision of this agreement may be construed as the University's consent to submit any claim, dispute or other matter in question for dispute resolution pursuant to any arbitration or mediation process, whether or not provisions for dispute resolution are included in a document which has been incorporated by reference into this agreement.

7.09.5 Condition Precedent

The process and procedures described in Article 7.09 are an express condition precedent to the Contractor filing or pursuing any legal remedy, including litigation. Pursuing litigation by the Contractor prior to exhaustion of the procedures set forth herein shall be premature and a material breach of this Agreement.
8.00 PAYMENT AND COMPLETION

8.01 Progress Payments

To assist in computing partial payments, the Contractor shall submit to the Design Professional and University a detailed “Schedule of Values” for review and approval by the University. The cost breakdowns shall be in sufficient detail for use in estimating the Work to be completed each month and shall be submitted within 10 days after the date of commencement of Work given in the Notice to Proceed.

Once each month during the progress of the Work, the Contractor shall submit to the Design Professional a partial payment request for review and approval. The partial payment request shall be based on the cost of the Work completed plus the acceptable materials delivered to or stored on the site under the control of the Contractor and not yet installed. The Design Professional and University shall review and certify by signature as to the validity of the request, and approving payment. Partial payments shall not be construed as acceptance of any Work which is not in accordance with the requirements of the Contract. Once the partial payment request has been certified by the Design Professional, it shall be submitted to the University for approval and processing.

The Contractor warrants that title to the Work, materials and equipment covered by an Application for Payment shall pass to the University upon the earlier of either incorporation in construction or receipt of payment by Contractor; that Work, materials and equipment covered by previous Applications for Payment are free and clear of liens, claims, security interests or encumbrances; and that no Work, materials or equipment covered by an Application for Payment will have been acquired by Contractor or by any other person performing Work at the Project or furnishing materials or equipment for the Project subject to an agreement under which an interest or encumbrance is retained by the seller or otherwise imposed on the Contractor or buyer.

All Applications for Payment shall be accompanied by sworn statements and waivers executed by Contractor, Subcontractors and suppliers whose work is included in the Application for Payment, as well as other documentation that may be required by the University, stating that all have been paid in full for Work performed through the last or most recent progress payment: The Contractor and each subcontractor shall also provide properly completed certified payroll form WH-347 to the University’s with each application for payment request.

8.02 Format of Application for Payment

In addition to a schedule of values or detailed outline for the Cost of Work that is acceptable to the Contractor and University, other specific requirements for Application for Payment format and calculations include.

- Applications for Payment shall first present the itemized Cost of Work.
  - For any portion of the Work being performed according to unit pricing or time and materials pricing, invoicing and Applications for Payment must be accompanied by acceptable supporting documentation to evidence accurate quantities of actual labor, materials and equipment. Any allowed mark-ups to the actual cost of Work performed will be added to these costs separately and not included in the actual cost.
  - Change Orders executed between the Contractor and University shall be reported as separate line items within the Application for Payment and directly under applicable Subcontractor Cost of Work items. Change Orders affecting multiple Subcontractors’ Cost of Work items shall be similarly numbered to permit ease of tracking. These requirements shall run through Subcontractor Applications for Payment to the Contractor to permit ease of tracking. Change Orders within a Subcontractor Application for
Payment shall be appropriately labeled as being initiated by the Contractor or University to permit ease of tracking.

- The Contractor's General Conditions, Overhead and Profit shall next be calculated as the balance of the Application for Payment.

8.03 Substantial Completion, Incomplete Construction List and Punchlist

When the Contractor considers that the Work, or a portion thereof which the University agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Design Professional a comprehensive Incomplete Construction List of items to be completed or corrected, in a form agreed by the University and the Design Professional. The Contractor shall proceed promptly to complete and correct items on the Incomplete Construction List. Failure to include an item on such Incomplete Construction List does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Upon receipt of the Contractor's Incomplete Construction List, the Design Professional, with the University's Representative, will make an observation to determine whether the Work or designated portion thereof is substantially complete and will identify observable items inconsistent with the Contract Documents to be included in the Punchlist. If the Design Professional's or University Representative's observation discloses any item, whether or not included on the Contractor's Incomplete Construction List, which is not in accordance with the requirements of the Contract Documents, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item, upon notification by the Design Professional.

The Contractor shall then submit a request for another observation by the Design Professional to determine Substantial Completion. When the Work or designated portion thereof is substantially complete, the Design Professional will prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion, shall establish responsibilities of the University and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time, generally 45 days, within which the Contractor shall finish all remaining Incomplete Construction List and Punchlist items accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion. The Certificate of Substantial Completion shall be submitted to the University and Contractor for their written acceptance of responsibilities assigned to them in such Certificate.

8.03.1 Partial Completion

From time to time, as portions of the Work are completed by the Contractor, the University shall have the right, upon giving the Contractor prior written notice, to accept any portion of the Work that the University desires to use and occupy. Such partial acceptance shall be made in writing and thereafter the Contractor shall have no further obligation with respect to the Work accepted, except to correct the Work subsequently found to have been improperly done, to replace defective materials or equipment, or as defined by Substantial Completion, Incomplete Construction List and Punchlist requirements.

8.04 Completion and Final Payment

Upon the Final Completion of the Work by the Contractor, the acceptance of the Work by the University, and the release of all claims against the University and the Work by the Contractor and its subcontractors and suppliers (which releases shall be evidenced by final waivers and releases or other documents acceptable to the University), the Contractor shall file a request for Final Payment.

8.04.1 Final Application for Payment
Upon the receipt of the Contractor's Final Application for Payment, including any and all waivers required by the University and the Contractor's provision of all Close-out Documents, and training requirements, the University shall promptly make a final inspection, and if the University finds the Work acceptable and complete in strict accordance with the Contract Documents, the University shall issue Final Payment. Final Payment shall be made upon Completion of the Work and shall indicate the University's Final Acceptance of the Work and its acknowledgment that the Work (excluding any further warranty and guaranty obligations) has been completed and is accepted under the terms and conditions of the Contract Documents. If prior to the making of Final Payment the University finds deficiencies in the Work, the University shall promptly notify the Contractor thereof in writing, describing such deficiencies in detail. After the Contractor has remedied any deficiencies noted by the University, the Contractor shall request a final inspection and the University shall make such inspection and follow the procedure set forth in this Paragraph.

8.04.2 Final Payment by the University

The making of Final Payment shall constitute a waiver of all claims by the University except those arising from: (1) unsettled liens; (2) faulty or defective work appearing after completion; (3) failure of the work to comply with the requirements of the Contract Documents; (4) terms of any special or extended warranties required by the Contract Documents; or (5) the obligations of the Contractor under the indemnification provisions of Paragraph 4.06 hereof.

The acceptance of Final Payment shall constitute a waiver of all claims by the Contractor.

8.05 Guarantee

The Contractor unconditionally guarantees the Work under this Contract to be in conformance with the Contract Documents and to be and remain free of defects in workmanship and materials not inherent in the quality required or permitted for a period required by the contract documents beginning from the date of Substantial Completion. The Subcontractors unconditionally guaranty the Work under the subcontracts to be in conformance with the Contract Documents and to be and remain free of defects in workmanship and materials for the same period from the date of Substantial Completion, unless a longer guarantee period is stipulated in the Contract Documents. By this guarantee the Contractor and Subcontractors agree, within their respective guarantee periods, to repair or replace any Work, together with any adjacent Work which may be displaced in so doing which is not in accordance with the requirements of the Contract or which is defective in its workmanship or material, all without any expense whatsoever to the University. The Contractor shall be responsible for the coordination of all such guarantee work performance or repairs.

Special guarantees that are required by the Contract Documents shall be signed by the Contractor or Subcontractor who performs the work.

Within their respective guaranty periods, the Contractor and Subcontractors further agree that within five calendar days after being notified in writing by the University of any Work not in accordance with the Contract Documents or of any defects in the Work, it shall commence and prosecute with due diligence all Work necessary to fulfill the terms of this guarantee and to complete the Work in accordance with the requirements of the Contract with sufficient manpower and material to complete the repairs as expeditiously as possible. The Contractor, in the event of failure to so comply, does hereby authorize the University to proceed to have the Work done at the Contractor's expense, and it agrees to pay the cost thereof upon demand. The University shall be entitled to reimbursement of all costs necessarily incurred upon the Contractor's or Subcontractor's refusal to pay the above cost.

Notwithstanding the foregoing paragraph, in the event of an emergency constituting an immediate hazard to health, safety or damage of the University's employees, property, or licenses, the University may undertake at the Contractor's or Subcontractor's respective expense, without prior notice, all Work necessary to correct
such hazardous conditions caused by the Work of the Contractor not being in accordance with the requirements of this Contract.

The Contractor and Subcontractor shall require a similar guarantee in all subcontracts, including the requirement that the University be reimbursed for any damage or loss to the Work or to other Work resulting from such defects.
9.00 TERMINATION

9.01 Termination by the University for Cause

9.01.1

The University may terminate the Contract if the Contractor: (a) becomes insolvent; (b) files or has filed against it any Petition in Bankruptcy or makes a general assignment for the benefit of its creditors; (c) fails to pay, when due, for materials, supplies, labor, or other items purchased or used in connection with the Work; (d) refuses or fails to prosecute the Work, or any separable part thereof, with such diligence as will ensure the completion of the Work in accordance with the Master Project Schedule; (e) in the University’s opinion, fails, refuses or neglects to supply sufficient labor, material or supervision in the prosecution of the Work; (f) interferes with or disrupts, or threatens to interfere with or disrupt the operations of the University, or any other Contractor, supplier, subcontractor, or other person working on the Project, whether by reason of any labor dispute, picketing, boycotting or by any other reason; or (g) commits any other breach of the Contract Documents.

When any of the above reasons exist, the University may, without prejudice to any other rights or remedies of the University and after giving the Contractor and the Contractor’s surety, if any, three days written notice and a reasonable opportunity to cure, terminate employment of the Contractor and may, subject to any prior rights of the surety: (1) take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor; (2) accept assignment of subcontracts; and (3) finish the Work by whatever reasonable method the University may deem expedient.

9.01.2

If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Design Professional’s services and expenses made necessary thereby, the remaining balance shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor shall pay the difference to the University. The amount to be paid to the Contractor or University, as the case may be, shall be certified by the Design Professional, upon application, and this obligation for payment shall survive termination of the Contract. The Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss or consequential damages arising out of or resulting from such termination. However, the University shall be entitled to retain whatever amount is remaining unpaid to the Contractor in order to correct the cause for termination; such action is in addition to any other right or remedy which the University may have.

9.02 Suspension by the University for Convenience

9.02.1

The University may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the University may determine.

9.02.2

An adjustment shall be made for increases in the Contract Sum and/or Time of Completion of the Contract, including profit on the increased cost of performance, caused by suspension, delay or interruption. No
Adjustment shall be made to the extent: (1) that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or (2) that an equitable adjustment is made or denied under another provision of this Contract. The Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss or consequential damages arising out of or resulting from such termination.

Adjustments made in the cost of performance may have a mutually agreed fixed or percentage fee.

9.03 Termination By The University For Convenience

9.03.1

The University, with or without cause, may terminate all or any portion of the services by the Contractor under this Agreement, upon giving the Contractor 30 days written notice of such termination. In the event of termination, the Contractor shall deliver to the University all reports, estimates, schedules, subcontracts, Contract assignments, purchase order assignments, and other documents and data prepared by it, or for it, pursuant to this Agreement.

9.03.2

Unless the termination is for cause, the Contractor shall be entitled to receive only the payments provided for in Article 8, pro-rated to the date of termination (including payment for the period of the 30 day notice) plus reimbursement for approved and actual costs and expenses incurred by the Contractor to the date of termination. Prior to payment, the Contractor shall furnish the University with a release of all claims against the University. The Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss or consequential damages arising out of or resulting from such termination.

9.04 Termination By The Contractor

9.04.1

The Contractor may terminate the Contract if the Work is stopped for a period of 60 days through no act or fault of the Contractor or a subcontractor, sub-subcontractor or their agents or employees or any other persons performing portions of the Work under Contract with the Contractor, for any of the following reasons: (1) issuance of an order of a court or other public authority having jurisdiction; (2) an act of government, such as a declaration of national emergency, making material unavailable; (3) because the Design Professional has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification, or because the University has not made payment on a Certificate for Payment within forty-five (45) days of the time stated in the Contract Documents; (4) if repeated suspensions, delays or interruptions by the University constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

If one of the above reasons exists, the Contractor may, upon fourteen (14) additional days' written notice to the University and Design Professional, terminate the Contract and recover from the University payment for Work executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including reasonable overhead and profit.

9.04.2

If the Work is stopped for a period of 60 days through no act or fault of the Contractor or a subcontractor or their agents or employees or any other persons performing portions of the Work under Contract with the Contractor due to University actions or inaction, the Contractor may, upon fourteen additional days' written
notice to the University and the Design Professional, terminate the Contract and recover from the University as provided in Subparagraph 9.03.2
10.00 MISCELLANEOUS

10.01
These Contract Documents supersede all previous agreements between the University and the Contractor concerning this Work.

10.02
No action or failure to act by the University shall constitute a waiver of a right afforded it under these General Conditions, nor shall such action or failure to act constitute approval or acquiescence of a breach of these General Conditions, except as may be specifically agreed in writing.

10.03
The invalidity or unenforceability of any provision of these General Conditions shall not affect the validity or enforceability of any other provision.

-End of General Conditions for Construction-
-End of General Conditions for Construction-
SUPPLEMENTARY GENERAL CONDITIONS

OF

CONSTRUCTION

Facilities Planning & Management - Design & Construction Services
Wayne State University

Complete Documents can be downloaded at
http://www.forms.procurement.wayne.edu/RFPs/Supplementary_General_Conditions_General_Contractor_1-3-2017.docx
SUPPLEMENTARY GENERAL CONDITIONS OF CONSTRUCTION (REVISED 7-2018)

Where any article of the General Conditions of the Contract for Construction is supplemented in these Supplementary General Conditions, the original article shall remain in full force and effect and all supplementary provisions shall be considered as added thereto. Where any such article is modified, superseded or deleted here, provisions of such article not so specifically modified, superseded or deleted shall remain in full force and effect.

4.00 RESPONSIBILITIES OF THE PARTIES

Add the following to 4.02.3

.1 Temporary Facilities

.a The Contractor shall be responsible for arranging and providing general services and temporary facilities as specified herein and as required for the Design Professional, the University, all Subcontractors, Separate Contractors and Contractor’s staff for the proper and expeditious prosecution of the Work, including, but not limited to, temporary offices and toilets; temporary storage; temporary electrical lighting and power; temporary voice and data communications; temporary water; temporary enclosures; temporary heating and ventilation; temporary openings; material hoists; temporary ladders, ramps and runways; temporary fire protection, protective coverings; temporary fire protection, protective coverings; and construction sign(s). The Contractor shall, at its own expense but included within the Cost of the Work, make all temporary connections to utilities and services in locations acceptable to the University, Design Professional and local authorities having jurisdiction thereof; furnish all necessary labor and materials, and make all installations in a manner subject to the acceptance of such authorities and the Design Professional; maintain such connections; remove the temporary installation and connections when no longer required; and restore the services and sources of supply to proper operating conditions.

.b The Contractor shall make all arrangements with the University and/or the local electrical utility company for temporary electrical service to the Site, shall provide all equipment necessary for temporary power and lighting, and shall pay all charges for this equipment and installation thereof. The electrical service shall be of adequate capacity for all construction tools and equipment without overloading the temporary facilities and shall be made available to all trades. The Contractor shall furnish, install and maintain a temporary lighting system to satisfy minimum requirements of safety and security.

.c Temporary weathertight enclosures and temporary heating shall be provided by the Contractor as required pursuant to the Construction Schedule or Master Project Schedule to complete the Work on or before the Completion Date, to make the building weathertight and suitable working conditions for the construction operations of all trades. Under no circumstances shall the temperature be allowed to reach a level which will cause damage to any portion of the Work which may be subject to damage by low temperatures. Unless otherwise indicated in the Construction Documents, the Contractor shall pay for all fuel, maintenance and attendance required in connection with the portable unit heaters without additional cost or expense to University. Any surface, interior or exterior, damaged by the use of these space heaters shall be replaced by new materials or be refinished to the satisfaction of the Design Professional and University without additional cost to the University.

.d All temporary equipment and conduits for same shall be in accordance with the applicable provisions of the governing codes. All temporary wiring and power conduits shall be maintained in a safe manner and utilized so as not to constitute a hazard to persons or property. All temporary equipment, wiring and conduits shall be completely removed after they are no longer necessary and prior to completion. At the conclusion of use or at the conclusion of the project, any materials or products purchased for the temporary facilities and temporary utilities and paid for, either directly
or indirectly, by the University shall become the property of the University and shall, at the option of
the University, be delivered to the University's designated location.

.e Where temporary facilities and associated utilities, and for utilities used in performance of this
Agreement can be reasonably provided from existing University services, the University shall bear
the cost of such utility consumption. However, for conditions that require the Contractor to use
electrical generators or equipment fueled by an independent fuel source, the Contractor shall bear
all such costs.

Add the following to 4.02.12

.1 Safety and Protection

.a Contractor shall provide fences, pedestrian walks, barriers, etc. to ensure safety of the general
public and Contractor's personnel or as directed by University.

.b Contractor will provide perimeter protection at wall and floor openings, elevator shafts,
stairwells, and floor perimeters in accordance with MIOSHA requirements.

.c Combustible rubbish shall be removed daily and shall not be disposed of by burning on site.
The entire premises and area adjoining and around the operation shall be kept in a safe and
sanitary condition and free of accumulation of trash, rubbish, nuts, bolts, small tools, and other
equipment not in use. Contractor is responsible to provide trash containers and fund the
removal/disposal of construction debris and general trash.

.d Contractor will regularly ensure that 1) excess material/trash are removed from work sites; 2)
passageways (e.g., sidewalks, hallways) are cleared of obstructions; 3) equipment is shut down
and secured; and 4) lighted barricades are erected where necessary.

.e All existing means of egress, including stairways, egress doors, panic hardware, aisles,
corridors, passageways, and similar means of egress shall, at all times, be maintained in a safe
condition and shall be available for immediate use and free of all obstructions.

.f The space under the temporary trailer shall not be used for the storage or placement therein of
flammable gases, liquids, or gas and liquid fuel powered equipment. This area shall be kept free of
accumulations of any rubbish or trash.

.g In temporary trailers, all exit doors shall be open for egress whenever the unit is occupied.
Draw bolts, hooks and other similar locking devices shall be prohibited on all egress doors.

.h On site storage of combustible or flammable liquids shall be limited to one day supply. Indoor
storage of propane containers is prohibited.

.i Prior to working in confined spaces on campus, the Contractor must have its written Confined
Spaces Program and Permit System reviewed by the University and the documents must meet
minimum acceptable standards under the current MIOSHA regulation(s). The Contractor must
provide its own atmospheric testing, personal protection, ventilating and rescue equipment as
required. The Contractor should seek information from University on any known hazards of the
confined spaces to be entered. All manholes and utility tunnels are considered confined spaces.

.j Compressed gas cylinders belonging to Contractor must be properly segregated and secured
(with chains or similarly reliable restraining devices) to wall or floor mounted support systems,
cylinder storage racks etc., when not in transit. Protective caps must be in place during transit or
when not in use.
Contractor must follow all of OSHA’s lockout/tagout requirements of 29 CFR 1910.147, provide its own lockout/tagout supplies, and be able to demonstrate that its employees have received formal instruction in “lock-tag-try” procedures. Copies of Contractor’s written Lockout/Tagout Program shall be made available to the University upon request.

Contractor may not use any University sinks, drains or catch basins for the washing of any equipment, tools or supplies, or the disposal of any liquids, (excluding consumable products and hand-soap/water) without the express permission of University. This restriction applies to all sinks (including water fountains) in laboratories, offices and maintenance areas. Additionally, no polluting or hazardous liquids (such as motor oils, cleaners, solvents, paints, diesel fuels, antifreeze, etc.) may be drained onto roads, parking lots, ditches, wetlands, dirt piles or other soil, or into storm or sanitary sewers.

Contractor transporting hazardous materials (e.g. reclaimed materials, chemicals, fuels, oils, concrete) to and from campus must follow all applicable Department of Transportation [State or Federal] regulations. This includes proper shipping papers, placarding, material segregation and weight limits.

Contractor is also responsible for the proper collection, labeling, transporting, manifesting and disposal of polluting or hazardous wastes such as solvents, paints, oil or antifreeze (and rags contaminated with any of these materials) which are the result of Contractor’s activities, as required by State and Federal laws and regulations. Copies of all manifests should remain available for University review upon request. Under no circumstances may hazardous wastes be disposed of in University-owned dumpsters, waste containers, drains or sewers, or drained onto roads, parking lots, ditches, wetlands, dirt piles or other soil.

Neither the University nor the Design Professional is responsible for conducting safety inspections or observations, but may make recommendations concerning safety to the Contractor.

Fire Protection

1. All reasonable precautions shall be taken against fire throughout all the Contractor’s and Trade Contractors’ operations. Flammable material shall be kept at an absolute minimum. Any such materials shall be properly handled and stored.

2. Construction practices, including cutting, welding and grinding, and protection during construction shall be in accordance with the applicable published standards. During such operations the Contractor shall provide a fire watch person. The University requires a “Hot Work” permit for such activities. The Contractor shall provide a sufficient number of approved portable fire extinguishers, distributed about the Project and in cold weather, non-freeze type portable fire extinguishers shall be used.

3. Gasoline and other flammable liquids shall be stored in and dispensed from Underwriter’s Laboratories listed safety containers in conformance with the National Board of Fire Underwriters recommendations and applicable State laws. Storage, however, shall not be within or immediately adjacent to the building. Storage shall be in a lockable, non-combustible, suitably rated cabinet or structure no less than 25 feet distant from any University building.

4. The Contractor shall schedule the Work so that the permanent standpipe system shall be installed and made operable at the earliest possible date.

4. All tarpaulins that may be used for any purpose during construction of the Work shall be made of material which is water and weather resistant and fire retardant treated. All tarpaulins shall be Underwriters’ Laboratories labeled with flame spread rating of fifteen (15) or less and shall be approved by the University’s Representative prior to use.
Add the following to 4.02.13

Hazard Communication: University requires the Contractor to be in full compliance with all applicable Federal and State of Michigan regulations regarding Material Safety Data Sheets ("MSDS"). Upon request, copies of these MSDS must also be provided to the University no less than two weeks prior to the onset of activities. Failure to submit MSDS may result in suspension of Work activities until the MSDS are obtained. If Contractor is to work with hazardous products, it shall notify and update the Project Manager of a) proposed work schedules, b) what to expect in terms of noises/odors, and c) how to access MSDS. The Contractor must also be able to demonstrate that its employees have received "Haz Com" (i.e. Michigan Right-to-Know), and thereby possess a broad understanding of MSDS language. Contractor-owned chemical containers must be labeled with the product name and hazards.

Hazardous Materials: In addition to complying with the Michigan Right-to-Know Law, the Contractor must use and store hazardous materials in accordance with all local, state and federal regulations. Special attention must be paid to the segregation of incompatible materials and the handling/storage of flammable and/or volatile materials. At the end of each work day, hazardous materials must be properly secured, stored in MIOSHA approved containers, and placed in locations authorized by the University or removed from University's property.

Add the following to 4.02.21

.1 Excavation Policy

The policy prescribed herein shall be adhered to for all earth excavation, manual or power, on the University campus that penetrates the surface of the soil by a depth of 6 inches or greater.

.a Non-emergency Situation

(1) In non-emergency situations (i.e., scheduled maintenance or construction) the Contractor shall contact the University a minimum of seven days in advance of the scheduled excavation.

(2) The Contractor shall contact Miss Dig, as defined by Public Act 174 of 2013, being MCL 460.721 – MCL 460.733, at least three full business days prior to the scheduled excavation, to ascertain and stake the actual location for all utilities within 50 feet of the limits of the proposed excavation. Actual staking shall be performed not more than three (3) days prior to the excavation.

(3) Excavation shall commence only with the approval of the University Representative after a complete examination of the site utility drawings and a field observation of the staked site.

.b Emergency Situation

1. In an emergency situation (i.e., loss of services on campus or to a building), the Contractor shall immediately contact the University Representative, examine the site utility drawings to determine the potential interferences, and contact Miss Dig and private stakers, if appropriate, to ascertain and stake the actual location of all utilities within 50 feet of the limits of the proposed excavation. The Contractor shall also immediately contact the local natural gas supplier in addition to Miss Dig, upon a natural gas line failure.

2. Contact the University's Police Department at the emergency number: (313) 577-2222.

3. Excavation shall recommence only with the approval of the University's Representative who will grant approval only after a complete examination of the site utility drawings and a field observation of the staked site and clearance from the utility and University Police Department.

.c Pumping and Draining
The Contractor shall provide and maintain a temporary drainage system and pumping equipment as required to keep all excavation areas within the Site free from water from any source. As the Work progresses, all water shall be removed from basement areas, tunnels, pits, trenches and similar areas as required for proper performance of the Work and to prevent damage to any part of the construction utility. Permanent sump pumps shall not be used for this purpose; however, the Contractor may install temporary pumps in the sump pits until the permanent pumps are installed, providing that it cleans sump pits and drain lines satisfactorily after temporary use. The Contractor shall provide and maintain all pumping and draining equipment as required for the installation of all underground piping and utility conduit systems. Pumping and draining shall be performed in a manner to avoid endangering concrete footings or any adjacent construction or property. Such methods shall be subject to the review of the Design Professional.

.d Post-Excavation

(1) Provide appropriate pipe protection (wraps, and/or cathodic protection) as originally installed.

(2) Provide backfill material and compaction in 12-inch lifts to a minimum 95% Maximum Dry Density or higher as required by the Specifications.

(3) Backfill material shall be as specified; or engineered fill free of all deleterious materials and rubbish of any type. Reuse of excavated material, unless otherwise specifically noted on the drawings, is unacceptable.

(4) Provide plastic tape trace 24" (12" for shallow trenches) above all utilities indicating utility type by Miss Dig color code and name defined as follows:

<table>
<thead>
<tr>
<th>Utility</th>
<th>Color</th>
<th>Lettering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric</td>
<td>Red</td>
<td>Elect</td>
</tr>
<tr>
<td>Oil/Natural Gas</td>
<td>Yellow</td>
<td>Gas</td>
</tr>
<tr>
<td>Telephone &amp; Fiber Optic</td>
<td>Orange</td>
<td>Tele</td>
</tr>
<tr>
<td>Cable TV</td>
<td>Brown</td>
<td>TV</td>
</tr>
<tr>
<td>Water</td>
<td>Blue</td>
<td>Water</td>
</tr>
<tr>
<td>Steam</td>
<td>Yellow</td>
<td>Steam</td>
</tr>
<tr>
<td>Sewer</td>
<td>Green</td>
<td>Sewer</td>
</tr>
</tbody>
</table>

(5) Return grade to pre-excavation condition.

Add the following to 4.05.1

The insurance furnished by the Contractor under this Article 4.05.1 shall provide coverage not less than the following:

.1 Workers’ Compensation with Employers’ Liability & Alternate Employers Endorsement:
   (a) Statutory Limits & Employer’s Liability $1,000,000

.2 Commercial General Liability
   (a) $1,000,000 per occurrence and $2,000,000 aggregate
   (b) University added as additionally insured on

.3 Contractors’ Pollution Liability:
   (a) $1,000,000 per claim

.4 Professional Liability:
   (a) $2,000,000 per claim and $4,000,000 aggregate

.5 Auto Liability with Pollution & Legal Liability
   (a) $1,000,000
(b) University added as additionally insured on

.6 Excess Liability (Umbrella):
   (a) $2,000,000

.7 Builder's Risk Insurance in the amount equal to the Contract Sum.

Any deductible or self-insured reserve shall not be refunded to the Contractor from project contingency or other project funds.

Add the following to 4.12

Elevator shafts, electrical closets, pipe and duct shafts, chases, furred spaces and similar spaces which are generally unfinished, shall be cleaned by the Contractor and left free from rubbish, loose plaster, mortar drippings, extraneous construction materials, dirt and dust before preliminary inspection of the Work.

All areas of the Project in which painting and finishing work is to be performed shall be cleaned throughout just prior to the start of this work, and these areas shall be maintained in satisfactory condition for painting and finishing. This cleaning shall include the removal of trash and rubbish from these areas; broom cleaning of floors; the removal of any plaster, mortar, dust and other extraneous materials from all finished surfaces, including but not limited to, all exposed structural steel, miscellaneous metal, woodwork, plaster, masonry, concrete, mechanical and electrical equipment, piping, duct work, conduit, and also all surfaces visible after all permanent fixtures, induction unit covers, convector covers, covers for finned tube radiation, grilles, registers, and other such fixtures or devices are in place.

In addition to all cleaning specified above and the more specific cleaning which may be required, the Project shall be prepared for occupancy by a thorough final cleaning throughout including washing or cleaning of all surfaces on which dirt or dust has collected. Glass and curtain wall shall be washed and cleaned on both sides by a window cleaning subcontractor specializing in such work. Contractor shall, at University’s request, delay such washing of exterior surfaces to such time as requested by University. Recleaning will not be required after the Work has been inspected and accepted unless later operations of the Contractor, in the opinion of the University, make re-cleaning of certain portions necessary.

5.00 INTERPRETATION OF AND ADHERENCE TO CONTRACT REQUIREMENTS

Add the following to 5.04.1

.1 Contractor Requirements

.a Signature: Each item submitted shall be thoroughly reviewed by the Contractor and have a stamp or note describing the Contractor’s action, signed by the person authorized by the Contractor to do the checking with that person’s name clearly printed.

.b Contractor Responsibility: Contractor shall review each submittal for completeness, conformance to the Contract Documents and coordination with other parts of the Work and the Construction Schedule. By providing and submitting to the Design Professional shop drawings, product data, warranties and samples, the Contractor is representing that he or his Subcontractor, has determined and verified (a) the availability of all materials, and (b) field measurements and field construction criteria related thereto, and (c) that he has checked and coordinated the information contained within such submittals with the requirements of the Work, the Contract Documents and
the Construction Schedule and that such shop drawings, samples, warranties and data conform to the Contract Documents.

c Limited Acceptance by University and Design Professional: Acceptance is for general design only. Quantities, size, field dimensions and locations are some of the required characteristics which are not part of the acceptance and will not be checked. Accordingly, the limited acceptance shall in no way relieve the Contractor from his obligation to conform his work to required characteristics and to the requirements of the Contract Documents.

d Delays: The Design Professional may return incomplete submittals with no action taken. The Contractor shall have no claim for any damages or for an extension of time due to delay in the Work resulting from the rejection of materials or from the rejection, correction, and resubmittal of Shop Drawings, samples and other data, or from the untimely submission thereof.

2 Approvals

The Design Professional’s approval shall not indicate approval of dimensions, quantities or fabrication processes unless specific notations are made by the Design Professional regarding same. The Design Professional will check one of the following notations on the Shop Drawing and Sample Review Stamp:

a "REVIEWED-NO EXCEPTIONS NOTED", indicating final action by the Design Professional. When reviewing resubmitted shop drawings the Design Professional assumes that there are no revisions from the previous submittal, except as provided by 5.04.1 and his review of resubmittals is only for the corrections requested with the approval of the balance of the shop drawing being based on the original submission. Where the Contractor directs specific action to revisions, as provided by 5.04.1 the approval includes these also.

b "REVIEWED WITH CORRECTIONS NOTED", indicating final action by the Design Professional with the same conditions as "REVIEWED-NO EXCEPTIONS NOTED". Unless he takes exception to the corrections noted, the Contractor may begin that portion of the Work for which the shop drawing was required.

c "REVISE AND SEND RECORD COPY", requiring that the Design Professional be sent a copy of the revised shop drawing in accordance with the noted corrections, at the same time it is issued for the Work.

d "NOT APPROVED-RESUBMIT", indicating that the Contractor shall not begin that portion of the Work until the reason indicated for disapproval has been corrected and the revised shop drawing submitted, reviewed and approved by the Design Professional.

e "NO ACTION REQUIRED", indicating that Contract Documents do not require the Design Professional to review or take any action with this submittal.

f Where more than one action has been checked, each shall apply to that portion of the shop drawing for which the action is indicated.

8.00 PAYMENT AND COMPLETION

Add the following to 8.01

8.01.1 Monthly Payment Applications

At a meeting mutually agreed upon between the University’s Representative and the Contractor, but no less than monthly, the Contractor shall distribute, in triplicate, draft copies of the proposed Payment Application for review and comment. The review, comment and mutual concurrence will be an
agenda item at that meeting. The Contractor will prepare the formal Application for submission from the comments made on the Draft and will present the formal application as provided for herein, including all required back-up materials, such as waivers of claim, release of claim on bond, sworn statement, documentation for stored materials, certified payroll reports and other documents required by the University Representative.

8.01.2 Offsite Materials

If an Application for Payment is made for materials not installed in the Work, but suitably stored off-site at a location acceptable to the University’s Representative, such application shall be accompanied by legally acceptable paid invoices or conditional bills of sale and copies of delivery tickets, signed by the Contractor, indicating the Contractor verified that the materials shown on the delivery tickets are at the location accepted by the University and are adequately insured. Failure of the Contractor to furnish paid invoices, conditional bills of sale and proof of insurance shall be cause for withholding such amounts from payment until such paid invoices or bills of sale have been received by the University. The University reserves the right to examine the stored items prior to payment.

Add the following to subparagraph 8.03

The following submittals shall be bound in three (3) sets, plus one electronic file of all materials:

.1 Project Closeout Documents

.a The Contractor shall submit to the Design Professional, a written guarantee, which shall be in accordance with Section 8.04 and such additional guarantees, in writing, as are required by the Specifications.

.b The Contractor shall submit complete instruction for the care and maintenance of all finish materials under the contract, including, but not limited to floor finishes and coverings, wainscot and wall finishes, acoustical treatment, metal finishes, painted surfaces, flooring, hardware, and finishes on mechanical and electrical equipment. Instructions shall contain the manufacturer’s or supplier’s recommendations with respect to cleaning agents, preservative treatment and such other instructions as may be beneficial to the maintenance, usage, appearance and durability of the product. The recommendations shall further contain cautions on the use of certain cleaners and coatings which may be detrimental to the product.

.c The Contractor shall prepare and submit operating and maintenance instructions, coordination drawings, and shop drawings for all mechanical and electrical equipment, and other special items, as called for in the specifications.

.d All of the above described documents shall be checked by Contractor for conformance with the specifications and shall be submitted in uniform size, bound and indexed for cross-reference.

.e The Contractor shall also submit "As-Built" drawings as specified in Section 4.11.

.f Copies of all "Attic Stock" transmittals signed by appropriate University personnel accepting the attic stock material.

.2 Project Closeout Training

a. The University and the Contractor will coordinate, schedule and present formal training for University personnel for all equipment, systems, devices, and building features.

b. Training shall be scripted to include all important aspects of the equipment and its installation and maintenance. Trainers shall be suitably prepared and experienced in the features of the equipment and the equipment’s installation within the project.
c. The Contractor, all product vendors, subcontractors, suppliers and materialmen shall consent to and participate in the recording of the training as determined by the University and the Contractor.

d. The University may supplement training with outside providers to meet the training requirements of the project should a vendor, subcontractor, or supplier fail to provide the required training. The University shall be reimbursed by the Contractor for any such costs for supplemental training.
The Technical Specifications dated **August 14, 2018** and the following List of Drawings represent the scope of work as defined in the Contract Documents from Article 4.

<table>
<thead>
<tr>
<th>Drawing No.</th>
<th>Description</th>
</tr>
</thead>
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GENERAL REQUIREMENTS

GENERAL

A. CONTRACTOR'S RESPONSIBILITY

It is not the responsibility of the Architect/Engineer or Owner's Representative to notify the Contractor or subcontractors when to commence, to cease, or to resume work; nor in any way to superintend so as to relieve the Contractor of responsibility or of any consequences of neglect or carelessness by him or his subordinates. All material and labor shall be furnished at times best suited for all Contractors and subcontractors concerned, so that the combined work of all shall be properly and fully completed on the date fixed by the Contract.

The Contractor shall be responsible for all items contained in both the specifications and on the drawings for all trades. He shall be responsible for the proper division of labor according to current labor union agreements regardless of the division of responsibility implied in the contract documents.

B. CODES AND STANDARDS

Reference to standard specifications for workmanship, apparatus, equipment and materials shall conform to the requirements of latest specifications of the organization referenced, i.e., American Society for Testing Materials (ASTM), Underwriters Laboratories, Inc. (UL), American National Standards Institute, Inc. (ANSI), and others so listed in the Technical Specifications.

C. PERMITS, FEES AND NOTICES

See Supplementary General Conditions.

D. MEASUREMENTS

Before proceeding with each Work Item, Contractor shall locate, mark and measure any quantity or each item and report quantities to Engineer. If measured quantities exceed Engineer’s estimate, Contractor shall obtain written authorization to proceed from Owner before executing Work required for that Work Item.

Measurement of quantities for individual Work Items will be performed by Contractor and reviewed by Engineer. Coordinate measurements with inspection as required in Section “Coordination.”

Cost of Work included in Work Item for quantities as indicated in Contract Documents shall be included in Base Bid.

   1. Additions to or deductions from lump sum price for quantities of each Work Item added to or deducted from Work respectively shall be at unit prices indicated in Bid Form and shall constitute payment or deductions in full for all material, equipment, labor, supervision and incidentals necessary to complete Work.

E. CONTRACTOR'S MEASUREMENTS

Before ordering material, preparing Shop Drawings, or doing any work, each Contractor shall verify, at the building, all dimensions which may affect his work. He assumes full responsibility for the accuracy of his figures. No allowance for additional compensation will be considered for minor discrepancies between dimensions on the drawings and actual field dimensions.

F. CONTINUITY OF SERVICE (Revised 3-26-2012)

Continuity of all existing services in the building shall be maintained throughout the construction period. Where it is necessary to tie into the existing electrical service, water or waste systems, it shall be done as directed by the Architect/Engineer. This Contract shall also provide temporary lines or bypasses that may be required to maintain continuous service in the building. All utility shutdowns must be approved by the Owners Representative / Project Manager, not less than 7 business days prior to the event, so that proper notification can be posted.

G. SUBMITTALS
All submittals (except Shop Drawings) and samples required by the Specifications shall be submitted in triplicate unless otherwise specified for a particular item under an individual Specification Section.

Each sample shall be clearly identified on a tag attached, showing the name of the Project Consultant, the project number and title, the names of the Contractor, manufacturer (and supplier if same is not the manufacturer), the brand name or number identification, pattern, color, or finish designation and the location in the work.

Each submittal shall be covered by a transmittal letter, properly identified with the project title and number and a brief description of the item being submitted.

Contractor shall be responsible for all costs of packing, shipping and incidental expenses connected with delivery of the samples to the Project Consultant or other designated address.

If the initial sample is not approved, prepare and submit additional sets until approval is obtained.

Materials supplied or installed which do not conform to the appearance, quality, profile, texture or other determinant of the approval samples will be rejected, and shall be replaced with satisfactory materials at the Contractor's expense.

H. GENERAL/STANDARD ELECTRONIC EQUIPMENT AND INFRASTRUCTURE REQUIREMENTS (Revised 11-2008)

1. Compliance with WSU Standards for Communications Infrastructure
   A. All applicable work, products, materials and methods shall comply with the latest version of the “WSU Standards for Communications Infrastructure” except as where noted.
   B. This document is available at the following website/URL: https://computing.wayne.edu/docs/wsu-communications-standards.pdf

2. Automation System Program Code
   A. All automation system uncompiled and compiled program codes, source codes, custom modules, graphical user interface screen shots and any other automation system programming data and material (Program Code) shall be provided to the UNIVERSITY in hard copy and on CD Rom in an unencrypted format acceptable to the UNIVERSITY.
   B. Copyright for the Program Code shall be assigned to the UNIVERSITY for purposes of system maintenance.

PROTECTION OF OCCUPANCY (Revised 3-2006)

A. FIRE PRECAUTIONS

Take necessary actions to eliminate possible fire hazards and to prevent damage to construction work, building materials, equipment, temporary field offices, storage sheds, and other property. During the construction, provide the type and quantity of fire extinguishers and fire hose to meet safety and fire prevention practices by National Fire Protection Association (NFPA) Codes and Standards (available at http://www.nfpa.org/)

In the event that construction includes “hot work”, the contractor shall provide the Owner's Representative with a copy of their hot work policy, procedures, or permit program. No hot work activity (temporary maintenance, renovation, or construction by operation of a gas or electrically powered equipment which produces flames, sparks or heat that is sufficient to start a fire or ignite combustible materials) shall be performed until such documents are provided. During such operations, all highly combustible or flammable materials shall be removed from the immediate working area, and if removal is impossible, same shall be protected with flame retardant shield.

Not more than one-half day's supply of flammable liquids such as gasoline, spray paint and paint solvent shall be brought into the building at any one time. Flammable liquids having a flash point of 100 degrees F. or below which must be brought into the building shall be confined in an Underwriters Laboratories (UL) labeled safety cans. The bulk supply of flammables shall be stored at least 75 feet from the building and other combustible materials. Spigots on drums containing flammable liquids are prohibited on the project site. Drums shall be equipped with approved vented pumps, and be grounded and bonded.
Only a reasonable working supply of combustible building materials shall be located inside the building.

All oil-soaked rags, papers, and other similar combustible materials shall be removed from the building at the close of each day's work, or more often if necessary, and placed in metal containers, with self-closing lids.

Materials and equipment stored in cardboard cartons, wood crates or other combustible containers shall be stored in an orderly manner and accessibly located, fire-fighting equipment of approved types shall be placed in the immediate vicinity of any materials or equipment stored in this type of crate or carton.

No gasoline, benzene, or like flammable materials shall be poured into sewers, manholes, or traps.

All rubbish shall be removed from the site and legally disposed of. Burning of rubbish, waste materials or trash on the site shall not be permitted.

The contractor shall be responsible for the conduct of employees relative to smoking and all smoking shall be in the area designated by the Architect/Engineer.

B. GENERAL SAFETY AND BUILDING PRECAUTIONS

Provide and maintain in good repair barricades, railings, etc., as required by law for the protection of the Public. All exposed material shall be smoothly dressed.

At dangerous points throughout the work environment provide and maintain colored lights or flags in addition to above guardrails.

Isolate Owner's occupied areas from areas where demolition and alteration work will be done, with temporary, dustproof, weatherproof, and fireproof enclosures as conditions may require and as directed by the Architect/Engineer.

Cover and protect furniture, equipment and fixtures to remain from soiling, dust, dirt, or damage when demolition work is performed in rooms or areas from which such items have not been removed.

Protect openings made in the existing roofs, floors, and other construction with weatherproof coverings, barricades, and temporary fire rated partitions to prevent accidents.

Repair any damage done to existing work caused by the construction and removal of temporary partitions, coverings, and barricades.

The Contractor will be held responsible for all breakage or other damage to glass up to the time the work is completed.

Provide protection for existing buildings, interior and exterior, finishes, walls, drives, landscaping, lawns (see below), etc. All damages shall be restored to match existing conditions to the satisfaction of the Architect/Engineer.

The Contractor and Owner will define the anticipated area of lawn damage at the project Pre-Construction Meeting. Whether the lawn is sparse or fully developed, any lawn damaged due to the Contractor's work will be replaced with sod by the University. The University's unit cost of $10.00 per square yard and landscaping at a rate of 1.5 times the cost of the sod repairs, the full cost of which will be assessed against the Contractor. At the completion of the project, a deductive Change Order reflecting this cost will be issued.

The Contractor is to include an allowance in his bid for this corrective work.

C. INTERFERENCE WITH OWNER'S OPERATIONS

The Owner will be utilizing the Building Facilities to carry on his normal business operation during construction. The Contractor shall schedule performance of the work necessary to complete the project in such a way as to interfere as little as possible with the operation during construction. The Contractor shall schedule performance of the work necessary to complete the project in such a way as to interfere as little as possible with the operation of the Owner.

Work which will interfere with the Owner's occupancy, including interruptions to the Owner's mechanical and electrical services, and essentially noisy operations (such as jackhammering) shall be scheduled in advance. The schedule of alterations shall be approved by the Architect/Engineer and the work shall be done in accordance with the approved schedule.
It is understood that the work is to be carried through to completion with the utmost speed consistent with good workmanship and to meet the construction schedule.

The Contractor shall begin work under the Contract without delay upon receipt of the fully-executed contract and shall substantially complete the project ready for unobstructed occupancy and use of the Owner for the purposes intended within the completion time stated in the contract.

The Contractor shall, immediately upon award of contract, schedule his work and expedite deliveries of materials and performance of subcontractors to maintain the necessary pace to meet the construction schedule.

**CONTRACTOR’S REPRESENTATION AND COORDINATION**

**A. FIELD SUPERINTENDENT**

Contractor shall assign a full time project manager/superintendent for the duration of the project. This person shall be experienced and qualified in all phases of the work and shall be present at the site during Contractor’s working hours. The project manager shall have Contractor’s full authority to represent Contractor in all routine operations including payment, changes to the work, and scheduling. Contractor shall not re-assign this individual without prior written permission of the Owner.

**B. MEETINGS**

When directed by the Architect/Engineer, meetings shall be held for the purpose of coordinating and expediting the work. The invited contractors or subcontractors will be required to have qualified representatives at these meetings, empowered to act in their behalf.

**C. COORDINATION**

The Contractor shall also provide a staff adequate to coordinate and expedite the work properly and shall at all times maintain competent supervision of its own work and that of its subcontractors to insure compliance with contract requirements.

The Contractor shall be solely responsible for all construction means, methods, techniques, sequences, and procedures and for coordinating all portions of the work under the Contractor.

**D. CONSTRUCTION SCHEDULE**

The Construction Schedule shall be prepared after the award of contract. Soon after, a pre-construction meeting is held with the Owner and the Architect/Engineer to determine the areas to which the Contractor will be allowed access at any one time.

The Contractor is alerted to the fact that areas in which he will be working will be occupied by students and employees of the University as well as the general public. The Contractor's access, to and from the project site, will be confined to limited areas so as not to unduly disrupt the normal activities of the University.

**TEMPORARY FACILITIES**

**A. GENERAL**

The following temporary facilities descriptions represent standard conditions. Verify accuracy with Architect/Engineer at time of bids.

**B. CONTRACTOR’S OFFICE**

Provide field offices as required. Locate temporary field offices on site where directed by Architect/Engineer.

Appearance and location of field offices shall be approved by the Architect/Engineer.

Provide for all other administrative facilities and storage off the Owner's property.

**C. STORAGE OF MATERIALS**
All materials shall be stored in areas designated by the Architect/Engineer. All stored materials shall be arranged for the minimum disruption to occupants and to allow full access to and throughout the building. Materials stored outdoors shall be neat and orderly and covered to prevent damage or vandalism.

D. PARKING
1. GENERAL
   University parking regulations will be strictly enforced.
   Maintain Owner's parking areas free of dirt and debris resulting from operations under the contract.

2. STANDING AND UNLOADING/LOADING VEHICLES
   All Contractors are to call Wayne State University Public Safety at 577-2222, and give at least 24 hours advance notice that they have vehicles that must be at the job site.
   Vehicles will be permitted at the project site only as long as the vehicles are needed for loading/unloading, and must be immediately moved upon completion.
   All unauthorized and/or unattended standing vehicles will be subject to ticketing and removal by University Police. Towed vehicles may be reclaimed by calling 577-2222, and paying any assessed charges.

3. COMPLIMENTARY PARKING
   There is no complimentary parking for Contractor's employee vehicles.

4. WAYNE STATE UNIVERSITY PUBLIC/STUDENT PARKING AREAS
   Public Parking, on a first-come first-served basis is available. Contact the office of the One Card System, at 313.577.9513 for information on availability of parking on a contractual basis.

E. TOILET FACILITIES
   The Owner's designated existing toilet facilities may be used by workers on the project. Contractor shall maintain such facilities in a neat and sanitary condition.

F. TELEPHONE USE
   If required, the Contractor shall provide and pay for a temporary telephone within the building for his use and that of his subcontractors.
   No use of the Owner's telephone (except pay telephones) will be permitted.

G. ACCESS DEVICES
   The Contractor shall furnish and maintain temporary hoists, ladders, railings, scaffolds, runways, and the like as required for safe, normal access to the permanent construction until the permanent facilities are complete. Each trade shall furnish such additional means of access as may be required for the progress and completion of the work. Such temporary access devices shall meet all applicable local, state, and federal codes and regulations.

H. HEAT AND VENTILATION
   Provide cold weather protection and temporary heat and ventilation as required during construction to protect the work from freezing and frost damage.
   Provide adequate ventilation as required to maintain reasonable interior building air conditions and temperatures, to prevent accumulation of excess moisture, and to remove construction fumes.
   Tarpaulins and other materials used for temporary enclosures. Coverings and protection shall be flameproofed.
I. WATER SERVICE

Sources of water are available at the site. The Owner will pay for reasonable amounts of water used for construction purposes.

The Contractor shall provide, at the earliest possible date, temporary connections to the water supply sources and maintain adequate distribution for all construction requirements. The Contractor shall protect sources against damage.

Methods of conveying this water shall be approved by the Architect/Engineer and shall not interfere with the Owner's operations.

J. ELECTRICAL SERVICES

All charges for reasonable amounts of electrical power energy used for temporary lighting and power required for this work will be paid by the Owner.

The Contractor shall provide and maintain any temporary electrical lighting and power required for this work. At the completion of the work, all such temporary electrical facilities shall be removed and disposed of by the Contractor.

Temporary lighting and power shall comply with the regulations and requirements of the National Electrical Code

INSPECTIONS AND TESTS

The Architect/Engineer shall at all times have access to the work wherever it is in preparation or in progress and the Contractor shall provide proper facilities for such access and for observation.

No failure of the Architect/Engineer, during the progress of the work, to discover or reject materials or work not in accordance with the Contract Specifications and Drawings shall be deemed an acceptance thereof nor a waiver of defects therein. Likewise, no acceptance or waiver shall be inferred or implied due to payments made to contractor or by partial or entire occupancy of the work, or installation of materials that are not strictly in accordance with the Contract Specifications and Drawings.

Where tests are specifically called for in the Specifications, the Owner shall pay all costs of such tests and engineering services unless otherwise stated in the contract.

Where tests are not specifically called for in the Specifications, but are required by the Architect/Engineer or Consultant, the Owner shall pay all costs of such tests and engineering services unless the tests reveal that the workmanship or materials used by the Contractor are not in conformity with the Drawings, Specifications, and/or approved shop drawings. In such event, the Contractor shall pay for the tests, shall remove all work and materials so failing to conform and replace with work and materials that are in full conformity.

CLEAN-UP

The Contractor shall at all times keep the Owner's premises and the adjoining premises, driveways and streets clean of rubbish caused by the Contractor's operations and at the completion of the work shall remove all the rubbish, all of his tools, equipment, temporary work and surplus materials, from and about the premises, and shall leave the work clean and ready for use. If the contractor does not attend to such cleaning immediately upon request, the Architect/Engineer may cause such cleaning to be done by others and charge the cost of same to the Contractor.

The Contractor will be responsible for all damage from fire that originates in, or is propagated by, accumulations of rubbish or debris.

All rubbish and debris shall be disposed of off the Owner's property in an approved sanitary landfill site. No open burning of debris or rubbish will be permitted. Job site shall be left neat and clean at the completion of each day's operation.

PROJECT CLOSE-OUT

A. RECORD DRAWINGS

At beginning of job, provide one copy of Working Drawings, and record changes, between Working Drawings and "As Built", including changes made by Addenda, Change Orders, Shop Drawings, etc. These shall be kept up to date.
Update to indicate make of all mechanical and electrical equipment and fixtures installed. Keep these Record Prints in good condition and available for inspection by the Architect/Engineer.

Upon completion of the job, turn over to the Architect/Engineer Record Prints of Working Drawings showing all job changes.

B. OPERATING AND MAINTENANCE DATA

Prepare and furnish to the Architect/Engineer three (3) bound copies of "Operating and Maintenance Manual" on all equipment installed under this Contract.

Manual shall include copies of all Manufacturers’ "Operating and Service Instructions", including Parts List, Control Diagrams, Description of Control Systems, Operating, Electrical Wiring, and any other information needed to understand, operate and maintain the equipment. The names and addresses of all subcontractors shall be included. These instructions shall be custom-prepared for this job — catalog cuts will not be accepted. Equipment shall be cross-referenced to Section of Specifications and to location shown and scheduled on drawings.


C. FINAL INSPECTION

Secure final inspections from the State of Michigan as soon as the work is completed and immediately submit such Certificates to the Architect/Engineer.

D. GUARANTEES (See Sections 00510 and 01781)

Guarantees on material and labor from the General Contractor and his subcontractors shall be as required in Sections 00510 and 01781.

E. SWORN STATEMENT AND WAIVER OF LIENS (revised 4-11-2012)

Prior to final payment, the General Contractor shall provide a Contractor's Sworn Statement and Full Unconditional Waivers of Liens from all subcontractors for material and labor and from all suppliers who provide materials exceeding $1,000. Sworn Statements and signed waivers from all Subcontractors must accompany Pay Applications or they will be returned for such documentation prior to approval.

ASBESTOS HAZARD

A. The contractor shall not start any work in any area that has not been inspected for asbestos by the Owner's Industrial Hygiene Department, or a qualified representative of the Owner and approval is given for work to be done. If asbestos is found, safety measures as recommended by the Owner's Industrial Hygiene Department, or a qualified representative of the Owner, shall be completed, or approval given for work to be done before work is started. The contractor shall not perform any asbestos removal or containment work under the contract.

KEYS

A. The Owner shall provide the contractor keys on loan to have access to the various spaces in order to complete the contract. Contractor will sign for and be responsible for each key on loan, returnable to Owner upon completion of the contract. In case of any lost keys, the Owner will backcharge the contract $250.00 for each core change. In the event that a Contractor wants access to a secured area, he shall give the Owner a minimum 48-hour notice.
SUMMARY OF WORK

SUMMARY OF WORK

PROJECT: Prentis Computer Lab Relocation 2018

WSU PROJECT NO.: 122-313456

PROJECT MANAGER: T. Allen Gigliotti

1. EXAMINATION

The Contractor shall visit the site and become familiar with conditions under which he will be working. Also meet with the project manager and review site access, storage areas, etc.

2. Description of Work – Project includes Renovate the 2nd floor of the Prentis Building to relocate Math & Computer Science computer labs from the Science & Engineering Library.

3. The building is located at
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5201 Cass
Detroit, Michigan 48202
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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General provisions of the Contract, including Owner’s Division 00, General and Supplementary Conditions, and Division 01 Specification Sections, apply to this Section.

B. Division 01 provisions of the Construction Specification, and the Construction Drawings, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Schedule of Values.
   2. Application for Payment.

1.3 SCHEDULE OF VALUES

A. Submit typed schedule on AIA Form G703 – Application and Certificate for Payment Continuation Sheet. Contractor’s standard form or electronic media printout will be considered.

B. Submit Schedule of Values in duplicate within 7 days after date of Owner-Contractor Agreement.

C. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the major specification Section. Identify site mobilization, bonds and insurance, breakdown by major category of work, or as directed by Architect.
   1. Include all contractor’s names with labor and material breakout.

D. Revise schedule to list approved Change Orders, with each Application For Payment.

1.4 APPLICATIONS FOR PAYMENT

A. Submit three copies of each application on AIA Form G702 - Application and Certificate for Payment.

B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

C. Include sworn statements, waivers and certified payroll.

D. Payment Period: Refer to Agreement.

1.5 CHANGE PROCEDURES

A. The Architect will advise of minor changes in the Work not involving an adjustment to Contract Sum/Price or Contract Time as authorized by AIA A201, 1987 Edition, Article 7.4 by issuing supplemental instructions.

B. The Architect may issue a Notice of Change, which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications. Contractor will prepare and submit an estimate within 5 days. Contractor’s response to include a formal proposal and detailed cost breakdown as required by WSU Project Manager.

C. Execution of Change Orders: The Owner will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 10 19
SECTION 01 18 13 – PROTECTION, RESTORATION AND NOTIFICATION

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 responsibilities for the protection, restoration and notification requirements for surface and subsurface structures, underground facilities and surface improvements.

1.3 NOTIFICATION AND INTERRUPTIONS

A. Prior to Start of Construction:
1. Notify MISS DIG at least 72 hours in advance at 1-800-482-7171 for exterior identification if applicable.
2. Contact each utility owner.
3. Arrange for the identification of the locations of existing underground facilities at or contiguous to the site.

B. Utility Interruptions:
1. Provide standby utility service for an interruption exceeding 2 hours.
2. Provide 72 hours notice to the affected occupants of the time and duration of the anticipated shut off.
3. Notify Fire Department 72 hours in advance if water main or fire supply line shut off is required.
4. Pay all costs relating to utility interruptions.

1.4 PROTECTION AND RELOCATION

A. Be responsible for:
1. Protection of structures and utilities at or contiguous to the site in accordance with the General Conditions.
2. Cost of cleaning, repair, relocation, raising, lowering, or replacement of structures and utilities which are damaged as a result of the Contractor's operations.
3. Cost of cleaning, repair, relocation, raising, lowering, or replacement of structures and utilities which are identified on the Drawings for relocation.
4. Temporary sheeting, bracing, poles, cables, sand fill or other means used to support a structure or utility exposed or endangered by the Contractor's operations.
5. Relocating, raising or lowering of a structure or utility for the Contractor's convenience.

1.5 RESTORATION

A. Acceptable Standards for Restoration:
1. Restore to the better of the following:
   a. Original condition.
   b. Requirements of the Contract Documents.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 18 13
SECTION 01 23 00 – ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General provisions of the Contract, including Owner’s Division 00, General and Supplementary Conditions, and Division 01 Specification Sections, apply to this Section.

B. Division 01 provisions of the Construction Specification, and the Construction Drawings, apply to this Section.

1.2 SUMMARY

A. This Section identifies each alternate and describes the basic changes to be incorporated into the Work, only when that alternate is made a part of the Work by specific provisions of the Contract Documents.

1.3 SCHEDULE OF ALTERNATES

A. Alternate 1:
   1. Basement HHW piping replacement.

B. Alternate 2:
   1. Third Floor HHW piping replacement.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 23 00
SECTION 01 25 13 – PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General provisions of the Contract, including Owner's Division 00, General and Supplementary Conditions, and Division 01 Specification Sections, apply to this Section.

B. Division 01 provisions of the Construction Specification, and the Construction Drawings, apply to this Section.

1.2 SUMMARY

A. This Section includes the administration of substitutions and Product options.

1.3 SUBMITTALS

A. List of all products proposed for installation:
   1. Submit 5 copies within 30 days after the Effective Date of Agreement unless otherwise indicated elsewhere in the Contract Documents.
   2. Tabulate the list by each Specification Section.

1.4 CONTRACTOR’S OPTIONS

A. Products specified only by reference standards or by description:
   1. Select any Product meeting the standards or description by any Supplier unless otherwise required elsewhere in the Contract Documents.
   2. Submit for Architect’s review:
      a. Name and address of Supplier.
      b. Trade name.
      c. Model or catalog designation.
      d. Manufacturer’s data including:
         1) Performance and test data
         2) Compliance with reference standards.

B. Products specified by naming one or more suppliers without an "or equal" clause:
   1. Use specified Product of one of the Suppliers named.
   2. No substitutions.

C. Products specified by naming one or more suppliers with an "or equal" clause:
   1. Indicates the option of selecting equivalent Products by stating "or equal" after the specified Suppliers.
   2. Architect may waive some or all of the requirements specified for substitutions if, at Architect’s sole discretion, the proposed equivalent Product is considered an "or equal".
   3. If, at Architect’s sole discretion, the proposed equivalent Product does not qualify as an "or equal", it will be considered as a proposed substitute and a substitution request submittal will be required.

1.5 SUBSTITUTIONS

A. Substitutions after the effective date of agreement:
   1. Within 30 days after the Effective Date of Agreement.
   2. Architect will consider formal requests for substitution of Products in place of those specified unless otherwise prohibited elsewhere in the Contract Documents.

B. Substitution Request Submittals: Submit 5 copies of the request for substitution including the following:
   1. Complete data substantiating compliance of the proposed substitution with the Contract Documents.
   2. For Products:
      a. Names and addresses of Manufacturer and Supplier.
      b. Product identification.
c. Manufacturer's literature, including:
   1) Product description.
   2) Performance and test data
   3) Reference standards.

d. Samples.
e. Name and address of similar projects on which the Product was used and date of installation.

3. For Construction Methods:
   a. Detailed description of the proposed method.
   b. Drawings illustrating methods.

4. Itemized comparison of proposed substitution with Product or method specified.
5. Data relating to changes in the construction schedule.
6. Accurate cost data on the substitution and comparison with the Product or method specified.
7. Changes to the Work which would be caused by the substitution.

C. Contractor's Responsibilities: In making a request for a substitution, Contractor represents:
   1. Contractor has personally investigated the proposed Product or method and determined that it is equal or superior in all respects to that which is specified.
   2. Contractor will provide the same guarantee for the substitution as for the Product or method specified.
   3. Contractor will coordinate installation of the accepted substitution into the Work making such changes as may be required for the Work to be completed in all respects.
   4. Contractor waives all claims for additional cost related to the substitution which consequently become apparent.
   5. Cost data is complete and includes all related costs under Contractor's contract, but excludes costs under separate contracts and Architect's redesign costs.

D. Substitutions Not Considered: Substitutions will not be considered if:
   1. They are indicated or implied on Shop Drawings or Product data submittals without formal request submitted in accordance with this Section.
   2. Acceptance will require substantial revision of the Contract Documents.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 25 13
SECTION 01 26 13 – REQUESTS FOR INFORMATION

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 procedures for Contractor to give notice of conflicts, errors, ambiguities, or discrepancies in the Contract Documents.

1.3 DEFINITIONS

A. Abbreviation: Request for Information (RFI).

1.4 REQUESTS FOR INFORMATION

A. Format:
   1. Use the enclosed RFI form or, at Contractor's option, generate form.
   2. Minimum required content of Contractor's RFI form:
      a. Project name.
      b. Name and address of Contractor.
      c. RFI number.
      d. RFI date.
      e. Name of initiator.
      f. Complete written request, with sketches as required.
      g. Signature of initiator.
      h. Space for written response by Engineer, with signature and date of Engineer's representative.

B. Procedures:
   1. Maintain a log of RFIs, including the RFI date and the date of the response.
   2. Allow at least 10 full working days for Engineer's response following Engineer's receipt of RFI.
   3. Submit written justification for shorter response time.
   4. Do not submit RFIs for information already included in the Contract Documents.
   5. Illegitimate RFIs may be cause for deductions in the Contract amount. See the Supplementary Conditions.
   6. RFIs submitted directly by subcontractors or vendors will be rejected.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 SCHEDULES

A. Attached is the following form suggested for use on this project:
   1. Request for Information.
REQUEST FOR INFORMATION

PAGE 1 OF 1

CONTRACT FOR: PROJECT NO.:

OWNER:

CONTRACTOR:

ENGINEER:

THE CONTRACTOR SHALL COMPLY WITH THE PROCEDURES IN DIVISION 01 SECTION "REQUESTS FOR INFORMATION."

RFI No.: FTCH Project Manager:

REQUEST

RFI From: Signature: Date:

RESPONSE

Response From: Signature: Date:

END OF SECTION 01 26 13
SECTION 01 31 13 – PROJECT COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General provisions of the Contract, including Owner's Division 00, General and Supplementary Conditions, and Division 01 Specification Sections, apply to this Section.

B. Division 01 provisions of the Construction Specification, and the Construction Drawings, apply to this Section.

1.2 SUMMARY

A. This Section includes provisions for coordination of the Work.

1.3 GENERAL COORDINATION

A. Coordinate scheduling, submittals and work of the various Sections of the Specifications to:
   1. Ensure efficient and orderly sequence of installation of interdependent construction elements.
   2. Provide for items to be installed later.

B. Interrelated Operating Equipment:
   1. Verify that characteristics of elements are compatible.
   2. Coordinate work of various sections having interdependent responsibilities for:
      a. Installation.
      b. Connection.
      c. Placing in service.

C. Shutdown of Existing Systems: Complete the WSU Building Notification Form regarding all impacts to the building and forward for approval 7 calendar days in advance of any shutdown of, or impact to, existing building systems.

D. In finished areas, except as otherwise indicated:
   1. Conceal pipes, ducts and wiring in the construction.
   2. Coordinate locations of fixtures and outlets with finish elements.

1.4 ACCEPTANCE OF CONDITIONS

A. Inspection:
   1. Prior to performing any work under a section:
      a. Carefully inspect the installed work.
      b. Verify that all such work is complete to the point where the work under that Section may properly commence.
      c. Starting of work indicates acceptance of the condition of components to which the work will be applied.
   2. Verify that all materials, equipment and Products to be installed under a Section may be installed in strict accordance with the original design and reviewed Shop Drawings.

B. Discrepancies:
   1. Resolve all discrepancies and conflicts between the trades.
   2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

1.5 SLEEVES AND INSERTS

A. Function: For pipes, conduits and similar items in forms, walls, partitions and floors.

B. Trades: Furnish required sleeves and inserts.
C. Place sleeve and inserts in ample time so as to not delay work.

D. Except as approved by Architect, do not place sleeves vertically through:
   1. Beams.
   2. Girders.
   3. Similar construction.

E. Maintain in proper position during subsequent work.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 31 13
SECTION 01 31 19 – PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General provisions of the Contract, including Owner’s Division 00, General and Supplementary Conditions, and Division 01 Specification Sections, apply to this Section.

B. Division 01 provisions of the Construction Specification, and the Construction Drawings, apply to this Section.

1.2 SUMMARY

A. This Section includes scheduling and administering of preconstruction and progress meetings.

B. Scheduling and Administration of Meetings:
   1. Responsibility:
      a. Preconstruction Meeting: Owner.
      b. Progress Meetings: Contractor.
   2. Procedures:
      a. Prepare agenda.
      b. Distribute written notice and agendas of meetings 4 days in advance of the meeting date.
      c. Make physical arrangements for the meetings.
      d. Preside at meetings.
      e. Record minutes and include significant proceedings and decisions.
      f. Distribute copies of the minutes within 4 days after meetings to:
         1) Participants.
         2) Others affected by proceedings.

1.3 PRECONSTRUCTION MEETING

A. Schedule: Preconstruction meeting will be scheduled by Owner:
   1. Before starting the Work at the Site.

B. Attendance: Representatives of the following parties are to be in attendance at the meeting:
   1. Owner.
   3. Contractor.

1.4 PROGRESS MEETINGS

A. Types of Progress Meetings:
   1. Regular.
   2. Called.

B. Schedule meetings as follows unless otherwise approved by Architect:
   1. Regular: Weekly.
   2. Called: As the progress of the Work dictates.

C. Location: Hold meetings at Site or as indicated in the notice.

D. Attendance: Representatives of the following parties are to be in attendance at the meeting:
   1. Architect/Engineer.
   2. Contractor.
   3. Owner’s representative as appropriate.
E. Minimum Agenda: The minimum agenda for progress meetings shall consist of the following:
1. Review and approve minutes of previous meetings.
2. Review safety procedures and protocols.
3. Review progress of the Work since the previous meeting.
4. Note field observations, problems and decisions.
5. Identify problems which impede planned progress.
6. Develop corrective measures and procedures to regain approved schedule.
7. Revise construction schedule as indicated.
8. Review submittal schedules; expedite as required to maintain schedule.
10. Review changes proposed by Owner for their effect on the construction schedule and completion date.
11. Identify all claims and potential claims.
12. Pending changes and substitutions.
13. Complete other current business.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 31 19
SECTION 01 32 16 – CONSTRUCTION PROGRESS SCHEDULE

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 preparation, furnishing, distribution and periodic revision of construction progress schedules.

PART 2 - PRODUCTS

2.1 FORM OF SCHEDULE
   A. Preparation:
      1. Prepare in the form of a horizontal bar chart, CPM network, or other form as approved by the Architect prior to submission.
      2. Provide a separate horizontal bar column or path for each trade or operation.
      3. Prepare the schedule in the chronological order of the beginning of each item of work.
      4. Identify each column or path by:
         a. Major Specification Section number.
         b. Distinct graphic delineation.
      5. Use a horizontal time scale and identify the first work day of each week.
      6. Allow space for updating.
   B. Size: The schedule sheets shall be 11 inches x 17 inches unless otherwise approved by the Architect.

2.2 CONTENT OF SCHEDULES
   A. Construction Sequence:
      1. Provide a complete sequence of construction by activity Milestones.
      2. For Shop Drawings, project data and Samples indicate the following:
         a. Submittal dates.
         b. Dates review copies will be required.
      3. Show decision dates for selection of finishes.
      4. Show Product procurement and delivery dates.
      5. Show dates for beginning and completion of each element of construction.
   B. Percentage Completion: Show the projected percentage of completion for each item of work as of the first day of each month.
   C. Subschedules:
      1. Provide separate subschedules showing submittals, review times, procurement schedules and delivery days.
      2. Provide subschedules to define critical portions of the entire schedule.
PART 3 - EXECUTION

3.1 SUBMITTAL

A. Preliminary Schedule:
   1. Submit the preliminary schedule within 10 days after the date of the Owner’s signature on the Agreement Supplement.
   2. The Architect will review schedule and will return the reviewed copy within 15 days after receipt.
   3. If required, resubmit within 7 days after receipt of a returned review copy.
   4. Upon request, meet with the Architect at least 10 days prior to the submission of the first Application for Payment to review the schedule.

B. Periodic Adjustment: Monthly, submit a revised schedule accurately depicting adjustments and progress to the first day of each month.

C. Number of Copies: Submit the number of copies required by the Contractor, plus 4 copies to be retained by the Architect.

3.2 DISTRIBUTION

A. Reviewed Schedules: Distribute copies of the reviewed schedules to:
   2. Subcontractors.
   3. Other concerned parties.

B. Instructions to Recipients: Instruct recipients to report inability to comply with the schedule, and provide detailed explanations with suggested remedies.

3.3 ADJUSTMENT OF PROGRESS SCHEDULE

A. Changes: Show changes occurring since previous submission of the schedule.

B. Progress: Indicate progress of each activity and show completion dates.

C. Other Items:
   1. Include major changes in scope.
   2. Include activities modified since previous updating.
   3. Include revised projections due to changes.
   4. Include other identifiable changes.

D. Narrative Report:
   1. Provide a narrative report including:
      a. A discussion of problem areas including current and anticipated delay factors and their impact.
      b. Direct action taken, or proposed, and its effect.
      c. A description of revisions including:
         1) Their effect on the schedule due to change of scope.
         2) Revisions in duration of activities.
         3) Other changes that may affect the schedule.
      d. The status of completion of Milestones.

END OF SECTION 01 32 16
SECTION 01 33 00 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General provisions of the Contract, including Owner's Division 00, General and Supplementary Conditions, and Division 01 Specification Sections, apply to this Section.

B. Division 01 provisions of the Construction Specification, and the Construction Drawings, apply to this Section.

1.2 SUMMARY

A. This Section includes procedures for the submittal of Shop Drawings, Product Data, Samples, Operation and Maintenance Manuals, and other information.

B. Related Sections include pertinent Sections of these Specifications for the individual Submittals required.

C. Submittal of samples to be in duplicate with Owner and A/E each receiving full submittal.

1.3 DEFINITIONS

A. Submittal: Information sent by Contractor to convey information about systems, equipment, materials, products, and administrative matters for the Work.

B. Resubmittal: Submittal sent for review a second or further time.

C. Product Data: Illustrations, standard schedules, diagrams, performance charts, instructions, brochures, or manufacturer's literature that describe the physical size, appearance, and other characteristics of materials or equipment for a portion of the Work.

D. Shop Drawings: Drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

E. Samples: Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

F. Action Submittals: Submittals that require A/E's response.

G. Informational Submittals: Submittals that do not require A/E's response.

H. Delegated-Design: In certain individual Specification Sections, design services or certifications by a design professional that are specifically delegated to the Contractor. Performance and design criteria are defined in the individual Specification Sections or on the Drawings. Contractor is solely responsible for design of those items or systems, and achieving specified performance.

1.4 SUBMITTAL PROCEDURES

A. Submittal Schedule:
1. Prepare and submit a Submittal schedule that identifies the following for each Submittal:
   a. Submittal number
   b. Submittal description
   c. Projected date Submittal will be submitted; based on when material is required on the job and in support of the project completion date.
2. An electronic copy (MS Excel file) of a blank Submittal schedule, in the preferred format, will be furnished by Architect at the preconstruction meeting.
3. Submittal Numbers:
   a. Use the applicable Specification Section number followed by a decimal point and then a sequential number (e.g., 06 10 00.1). Where a Submittal is required via a Drawing (instead of a Specification Section), use the applicable Drawing Number followed by a decimal point and then a sequential number (e.g., M501.1.1).
   b. Resubmittals shall include a letter suffix after another decimal point (e.g., 06 10 00.1.A).
   c. Submittals that are not numbered correctly may be rejected.

B. Delivery Method:
1. Submittals may be delivered as paper copies or electronic files at Contractor’s option.
2. Advise A/E of delivery method to be used at the preconstruction meeting.
3. Where Submittals include information that is intended to be printed on sheets larger than 11 inches x 17 inches, or where scale or drawing size are critical for proper review, submit 3 paper copies for review.
4. Paper Copies:
   a. Unless indicated otherwise, submit 3 copies of each Submittal.
   b. One copy of each Action Submittal will be returned to Contractor.
   c. Extra copies submitted by Contractor will be discarded.
5. Electronic Files:
   a. Unless indicated otherwise, submit 1 copy of each Submittal in PDF format.
   b. Scanned Submittals shall be produced in such a way as to not compromise the graphic quality or accuracy of scale, where applicable; and text shall be searchable.
   c. One copy of each Action Submittal will be returned to Contractor.
   d. Submittals may be transmitted via electronic mail (e-mail) or on a CD or DVD. Submittals that are transmitted electronically may be returned electronically at the Architect’s discretion.
6. Transmit Submittals to party and address identified by Architect at preconstruction meeting.

C. Coordination and Timing: Coordinate preparation and processing of Submittals with performance of construction activities. Contractor is responsible for cost of delays caused by lack of coordination or tardiness of Submittals. Incomplete Submittals will be rejected.
1. Coordinate each Submittal with fabrication, purchasing, testing, delivery, other Submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of Submittals for related parts of the Work so processing will not be delayed because of need to review Submittals concurrently for coordination.
   a. Architect reserves the right to withhold action on a Submittal requiring coordination with other Submittals until related Submittals are received.

D. Processing Time: Allow 10 full working days for Architect to review each Submittal, including Resubmittals. Time for review shall commence on Architect’s receipt of Submittal. No extension of the Contract Time will be authorized because of failure to transmit Submittals enough in advance of the Work to permit processing, including Resubmittals. Architect will advise Contractor when a Submittal being processed must be delayed for coordination.

E. Identification: Place a permanent label on each Submittal or generate a separate cover sheet.
1. Indicate name of firm or entity that prepared Submittal.
2. Provide space to record Contractor’s review and approval markings and action taken by Architect.
3. Include the following information:
   a. Project name.
   b. Date.
   c. Name and address of Architect.
Submittal Procedures

Section 01 33 00

d. Name and address of Contractor.
e. Name and address of Subcontractor(s).
f. Name and address of Supplier(s).
g. Name of Manufacturer.
h. Submittal number, including revision identifier.
i. Drawing number and detail references, as applicable.
j. Location(s) where product is to be installed, as applicable.
k. Other necessary identification.

F. Deviations: Encircle or otherwise specifically identify deviations from the Contract Documents on Submittals. Submittals that include deviations that are not identified may be rejected. Architect may or may not consider deviations. Deviations are not substitutions. Refer to Division 01 Section "Product Substitution Procedures" for procedures regarding requests for substitutions.

G. Transmittal: Package each Submittal individually and appropriately for transmittal and handling. Transmit each Submittal using a transmittal form. Architect will reject Submittal(s) received from sources other than Contractor.

H. Resubmittals: Make Resubmittals in same form and number of copies as initial Submittal.
   1. Note date and content of previous Submittal.
   2. Clearly identify additions and revisions.
   3. Resubmit Submittals until they are marked, “Reviewed, No Exceptions Noted” or “Reviewed With Corrections Noted.”

I. Distribution: Furnish copies of Submittals with mark indicating, “Reviewed, No Exceptions Noted” or “Reviewed With Corrections Noted,” to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities.

J. Use for Construction: Unless otherwise indicated by Architect, use only Submittals with mark indicating, “Reviewed, No Exceptions Noted” or “Reviewed With Corrections Noted.”

1.5 CONTRACTOR’S USE OF ARCHITECT’S ELECTRONIC DRAWING FILES

A. At Contractor’s written request, copies of Architect’s electronic Drawing files of the floor plans may be provided to Contractor for Contractor’s use in connection with Project, including Submittal preparation. Electronic files may be furnished by Architect for the convenience of the Contractor. Conclusions or information obtained or derived from such electronic files will be at the Contractor’s sole risk. Materials furnished by Architect that may be relied upon are limited to printed Contract Documents.

B. When Contractor uses Architect’s electronic Drawing files to facilitate Submittal preparation, prepare Submittals to be project specific. Submittals that are not project specific, including Architect’s Drawing files submitted on a new title block, will be rejected.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit project specific Action Submittals required by individual Specification Sections. Do not use highlighting that would not be reproducible.

B. Product Data: Collect information into a single Submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for Submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each Submittal to indicate which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer’s written recommendations.
      b. Manufacturer’s product specifications.
      c. Manufacturer’s installation instructions.
Submittal Procedures

Section 01 33 00

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale where appropriate. Scale shall be sufficiently large to indicate pertinent features of the item and its method of connection to the Work.

1. Preparation: Fully illustrate requirements of the Contract Documents. Include the following information, as applicable:
   a. Dimensions.
   b. Identification of products.
   c. Fabrication and installation drawings.
   d. Colors and materials as applicable.
   e. Roughing-in and setting diagrams.
   f. Wiring diagrams showing field-installed wiring, including power, signal, control, and communication wiring. Differentiate between Manufacturer-installed and field-installed wiring.
   g. Manufacturing instructions.
   h. Templates and patterns.
   i. Schedules.
   j. Calculations.
   k. Compliance with specified standards.
   l. Notation of coordination requirements.
   m. Notation of dimensions established by field measurement.
   n. Relationship to adjoining construction clearly indicated.

2. Sheet Size: Submit Shop Drawings on sheets at least 8-1/2 inches x 11 inches but no larger than 36 inches x 48 inches.

3. Maintain copy of returned Submittal for Project records.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements, and for a comparison of these characteristics between Submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components, such as accessories, together in one Submittal package.

2. Identification: On unexposed side of Samples, attach label that includes the following:
   a. Generic description of Sample.
   b. Product name and name of Manufacturer.
   c. Sample source.
   d. Number and title of appropriate Specification Section.

3. Samples for Initial Selection: Submit Manufacturer’s color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available. Where Contract Documents indicate custom color or material, coordinate production of custom Samples with the Architect and Manufacturer prior to submittal.
   a. Number of Samples: Unless indicated otherwise, submit 3 full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from Manufacturer’s product line. A/E will return 1 Sample with options selected.

4. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, physically identical with material or product proposed for use, and that show full range of color and texture variations expected.

5. Samples include, but are not limited to, the following: Partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
6. Number of Samples: Unless indicated otherwise, submit 3 sets of Samples to A/E and 1 set to Owner.
   A/E will retain 1 Sample set; remainder will be returned. Owner will retain samples.
   a. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
   b. If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

7. Disposition: Maintain sets of approved Samples at Site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used by A/E to determine final acceptance of construction associated with each set.
   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples shall be in an undamaged condition at time of Substantial Completion.
   b. Samples not incorporated into the Work, or otherwise designated to become Owner's property, are the property of Contractor.

E. Operation and Maintenance Manuals:
   1. General:
      a. Where manuals are required to be submitted covering items included in the Work, prepare such manuals in durable plastic binders approximately 8-1/2 inches X 11 inches in size and with at least the following:
         1) Identification on, or readable through, the front cover stating general nature of the manual.
         2) Neatly typewritten index near the front of the manual.
         3) Complete instructions regarding operation and maintenance of equipment involved, including:
            a) Equipment function, normal operating characteristics, and limiting conditions.
            b) Assembly, installation, alignment, adjustment, and checking instructions.
            c) Operating instructions for start-up, routine and normal operating, regulation and control, shutdown, and emergency conditions.
            d) Maintenance instructions, including lubrication requirements where applicable.
            e) Guide to "troubleshooting".
            f) Parts lists and predicted life of parts subject to wear.
            g) Project specific outline and cross sections, assembly drawings, Architecting data, and wiring diagrams. Wiring diagrams shall reflect final, as-installed conditions and include wire numbers.
            h) Test data and performance curves.
         4) Complete nomenclature of all replaceable parts, their part numbers, current costs, and name and address of nearest vendor of parts.
         5) Copies of guarantees and warranties issued.
         6) Copies of the reviewed Submittals.
         7) Copies of data concerning changes made during construction.
   2. Extraneous Data: Where contents of the manuals include Manufacturer's catalog pages, clearly indicate the precise items included in this installation and delete all Manufacturers' data with which this installation is not concerned. Do not use highlighting that would not be reproducible.
   3. Number of Copies Required: Unless otherwise specifically directed by A/E, or stipulated in the pertinent Section of these Specifications:
      a. For review, submit 1 paper and 1 electronic copy.
      b. For record, deliver 4 paper and 1 electronic copies to A/E and Owner.
   4. Schedule delivery of record copies of operation and maintenance manuals at least 60 days prior to startup of respective equipment, unless otherwise specified.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by individual Specification Sections. Do not use highlighting that would not be reproducible.

B. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects/Architects and owners, and other information specified.

D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

E. Installer Certificates: Prepare written statements on Manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by Manufacturer for this Project.
   1. Special attention to Low Voltage Electrical System installer.

F. Manufacturer Certificates: Prepare written statements on Manufacturer's letterhead certifying that Manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

G. Product Certificates: Prepare written statements on Manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

H. Material Certificates: Prepare written statements on Manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

J. Product Test Reports: Prepare written reports indicating current product produced by Manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by Manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

K. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   1. Name of evaluation organization.
   2. Date of evaluation.
   3. Time period when report is in effect.
   4. Product and manufacturers' names.
   5. Description of product.
   6. Test procedures and results.
   7. Limitations of use.

L. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

M. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

N. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents; such as, but not limited to WSU C&IT test report requirements.
O. Manufacturer's Instructions: Prepare written or published information that documents Manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of Manufacturer. Include the following, as applicable:
1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

P. Manufacturer's Field Reports: Prepare written information documenting tests and inspections of factory-authorized service representative. Include the following, as applicable:
1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement of substrate condition and acceptability of substrate for installation or application of product.
3. Statement that products at Site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
8. Other required items indicated in individual Specification Sections.

Q. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to A/E.
1. A/E will not review Submittals that include MSDSs and will return the entire Submittal for Resubmittal.

2.3 DELEGATED-DESIGN SUBMITTALS

A. Where design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

B. Performance type design documents and calculations shall be prepared by a design professional as required by the individual Specification Section, licensed in the State where the Project is being constructed. Design documents shall be signed and sealed by the responsible design professional. Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Identify name and version of software, if any, used for calculations.

C. In addition to Shop Drawings, Product Data, and other required Submittals, submit two copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each Submittal and check for coordination with other work of the Contract and for compliance with the Contract Documents. Verify field dimensions and conditions; note corrections as necessary. Mark with approval stamp before submitting to A/E.
1. Approval Stamp: Stamp each Submittal with an approval stamp. Use the same stamp format for each Submittal. Include Project name and location, Submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that Submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
B. Submittals that are not approved and stamped by Contractor will be rejected.

3.2 POSTING

A. Contractor to post reviewed submittals and shop drawings to a FTP site; and provide access to Owner, Architect, and all other project team members.

3.3 A/E’S REVIEW

A. Action Submittals: A/E will review Action Submittals, make marks to indicate corrections or modifications required, and return Submittal. A/E will stamp each Submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. Reviewed, No Exceptions Noted: Submittal appears to conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Reviewed With Corrections Noted: Upon incorporation of review comments, it appears that Submittal will conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

3. Revise and Resubmit: Submittal has one or more specific segments that are incomplete, do not appear to conform to the information given in the Contract Documents, or are incompatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Contractor shall resubmit information for review to demonstrate understanding of comments and portions of Work to be provided. Except as noted, Contractor shall not proceed with work related to Submittal.

4. Rejected, Resubmit: Submittal as a whole is incomplete, does not appear to conform to the information given in the Contract Documents, or is incompatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Contractor shall resubmit information for review to demonstrate understanding of comments and portions of Work to be provided. Contractor shall not proceed with work related to Submittal.

B. Informational Submittals: Other Submittals required by the Contract Documents are for information only. A/E will acknowledge receipt of Informational Submittals. Such Submittals include, but are not limited to:

1. Qualifications Data.
2. Certificates.
3. Test Reports.
4. Manufacturer’s Instructions.
5. Maintenance Data.
6. Field Reports.


D. Submittals not required by the Contract Documents will be returned without being reviewed.

E. Partial Submittals are not acceptable, will be considered non-responsive, and will be rejected.

3.4 RE-REVIEW COSTS

A. Compensation:

1. Should A/E be required to review a Submittal more than twice because of failure of the Submittal to meet the requirements of the Contract Documents, A/E will record A/E’s expenses for performing additional reviews.

2. Owner will compensate A/E for these additional services and deduct the amount paid from payments to Contractor.

END OF SECTION 01 33 00
SECTION 01 42 00 – REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General provisions of the Contract, including Owner's Division 00, General and Supplementary Conditions, and Division 01 Specification Sections, apply to this Section.

B. Division 01 provisions of the Construction Specification, and the Construction Drawings, apply to this Section.

C. WSU Construction Design Standards, C&IT Communication Standards, Wayne State University Police Standards, and all other WSU testing requirements, permitting, and other regulatory considerations.

1.2 SUMMARY

A. This Section includes provisions for references throughout the Contract Documents.

1.3 DEFINITIONS

A. Abbreviations:
1. AASHTO - American Association of State Highway and Transportation Officials, 444 North Capitol Street, N.W., Suite 249, Washington, DC 20001.
2. ACI - American Concrete Institute, 38800 Country Club Dr., Farmington Hills, MI 48331.
3. AISC - American Institute of Steel Construction, Inc., One East Wacker Dr., Suite 700, Chicago, IL 60601-1802.
5. ANSI - American National Standards Institute, 25 West 43rd St., 4th Floor, New York, NY 10036.
7. ASTM - American Society for Testing and Materials, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959.
8. AWS - American Welding Society, Inc., 550 N.W. LeJeune Road, Miami, FL 33126.
9. AWWA - American Water Works Association, 6666 West Quincy Avenue, Denver, CO 80235.
10. CPA – Composite Panel Association, 19465 Deerfield Avenue, Suite 306, Leesburg, VA 20176.
11. CRSI - Concrete Reinforcing Steel Institute, 933 Plum Grove Road, Schaumburg, IL 60173-4758.
12. MDEQ – Michigan Department of Environmental Quality, 525 West Allegan Street, P.O. Box 30473, Lansing, MI 48909-7973.
13. MDNR - Michigan Department of Natural Resources, 530 West Allegan Street, P.O. Box 30028, Lansing, MI 48909.
14. MDOT - Michigan Department of Transportation, 425 West Ottawa Street, P.O. Box 30050, Lansing, MI 48909.
15. MDCH - Michigan Department of Community Health, 201 Townsend Street, Lansing, MI 48913.
16. MIOSHA - Michigan Department of Licensing and Regulatory Affairs, Michigan Occupational and Health Administration, State Secondary Complex, 7150 Harris Drive, P.O. Box 30643, Lansing, MI 48909-8143.
17. NCMA - National Concrete Masonry Association, 13750 Sunrise Valley Drive, Herndon, VA 20171-4662.
18. NEC - National Electrical Code (see NFPA 70).
19. NEMA - National Electrical Manufacturers’ Association, 1300 N. 17th Street N.W., Suite 1752, Rosslyn, VA 22209.
21. PCI - Precast Concrete Institute, 200 West Adams, Suite 2100, Chicago, IL 60606.
22. SDI - Steel Deck Institute, P.O. Box 25, Fox River Grove, IL 60021.
23. SJI - Steel Joist Institute, 234 West Cheves Street, Florence, SC 29501.
24. UL - Underwriters’ Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.
1.4 REFERENCES

A. The provisions of the Contract Documents shall govern over any conflicting provisions of the referenced documents.

B. The provisions of laws and regulations shall govern over any conflicting provisions of the referenced documents.

C. Comply with the referenced document that is in effect as of the Bid date, except when a specific date is specified.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 42 00
SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General provisions of the Contract, including Owner's Division 00, General and Supplementary Conditions, and Division 01 Specification Sections, apply to this Section.

B. Division 01 provisions of the Construction Specification, and the Construction Drawings, apply to this Section.

1.2 SUMMARY

A. This Section includes the following items to facilitate construction:
   2. Contractor's field offices.
   4. Temporary heat.
   5. Temporary partitions.
   6. Storage areas.
   7. Project signs.

1.3 SUBMITTALS

A. Samples: For construction project identification sign.
   1. Required Sample:
      a. 11 x 17 color proofs of sign representing actual appearance of sign producer's final product.
      b. Created by sign producer.
   2. Submit and obtain review by Architect prior to printing final version of vinyl.

1.4 STORAGE AREAS

A. Locations:
   1. Interior: There will be no predesignated interior storage area(s) for contractor use.
      a. Storage needs beyond what can be accommodated within the limits of the area under construction will be considered by the Owner on an individual basis.

PART 2 - PRODUCTS

2.1 UTILITIES

A. Temporary Utilities:
   1. Water: Obtain water by connection to Owner's existing water system.
   2. Electricity:
      a. Obtain electrical power by connecting to Owner's existing system.
      b. Furnish, install, remove and pay for all temporary wiring, equipment switches, panels, connections and transformers.
      c. Furnish, install, remove, and pay for area distribution boxes so located that power and artificial lighting are located at all points where required by the Work.
      a. Provide lighting levels meeting minimum requirements for proper performance and observation of the work.
      b. Existing lighting fixtures to be demolished may remain in place if not prohibiting execution of work.
   5. Sanitary Facilities: Specific restrooms within the building will be designated for contractor use.
      a. Condition of facilities to be maintained in clean and orderly fashion.
2.2 FIELD OFFICES

A. Contractor's Field Office:
1. No trailer will be allowed on University property.
2. Contractor's office functions to be handled within limits of construction.

2.3 CONSTRUCTION HEATING

A. Permanent Heating Equipment:
1. Prior to use in areas of construction, provide adequate means to keep internal duct and acoustic liner surfaces clean and in a like-new condition.
2. Filters:
   a. Securely supported at each return and exhaust air open duct end and grille.
   b. Support filter length at required intervals to prevent filter deformation.
   c. Replaced at intervals required to keep internal duct and acoustic liner surfaces free of construction debris and dust.
3. At substantial completion of space(s) being served in the work area, ductwork used by Contractor shall be cleaned to Engineer’s satisfaction.

B. Temperatures:
1. Except as otherwise called for, a minimum temperature of 50 degrees F and a maximum temperature of 75 degrees F in construction areas shall be maintained at all times.
   a. Maintain typical temperatures in areas of general building use.
2. See requirements of various other Sections of these Specifications for minimum temperature to be maintained for the application of work under the various trades.

2.4 TEMPORARY PARTITIONS

A. Provide separation between public areas and work area, where existing door or wall is temporarily removed.
1. Wall must have smoke/fire rating as required by Code and AHJ.
2. Wall must not damage existing surfaces to remain.
3. See Drawings for specific requirements.

2.5 STORAGE AREAS

A. Construction materials and supplies to be kept within the confines of the work areas.

2.6 PROJECT IDENTIFICATION SIGNAGE

A. No signage announcing names of parties involved with construction process will be allowed on University property.

PART 3 - EXECUTION

3.1 REMOVAL

A. Maintain all temporary facilities and controls as long as needed for the safe and proper completion of the Work. Remove all such temporary facilities and controls as rapidly as progress of the Work will permit. Remove exterior sign when directed to by Owner.

END OF SECTION 01 50 00
SECTION 01 66 00 – PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General provisions of the Contract, including Owner's Division 00, General and Supplementary Conditions, and Division 01 Specification Sections, apply to this Section.

B. Division 01 provisions of the Construction Specification, and the Construction Drawings, apply to this Section.

1.2 SUMMARY

A. This Section includes provisions for the storage and protection of Products.

1.3 STORAGE AND PROTECTION

A. Delivery: All contractor deliveries to be supervised, received at the loading dock, and routed coordinated in advance with the Dock manager. Large material deliveries and large items are not allowed through the main entrance.

B. Storage:
   1. Maintain ample way for foot traffic at all times, except as otherwise approved by A/E or Owner.
   2. Repair or replace property damaged by reason of storing of material at no additional cost to Owner.
   3. Packaged Materials:
      a. Delivered in original, unopened containers.
      b. Stored until ready for use.
   4. Materials shall meet the requirements of these Specifications at the time that they are used in the Work.
   5. Store Products in accordance with Manufacturer's instructions.

C. Protection:
   1. Use all means necessary to protect the:
      a. Products of every Section before, during and after installation.
      b. Installed work and materials of all trades.
   2. All materials shall be delivered, stored and handled to prevent:
      a. The inclusion of foreign materials.
      b. Damage by water, breakage or other causes.

D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of Architect/Engineer and at no additional cost to Owner.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 66 00
SECTION 01 71 36 – MONITORING OF EXISTING CONDITIONS

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 monitoring of building cracks.

1.3 SYSTEM DESCRIPTION

A. Crack Monitoring: Instrumentation permitting the widths of existing cracks to be measured and reported.

1.4 PERFORMANCE REQUIREMENTS

A. Contractor’s Responsibilities:
1. Contractor will be held responsible for damage to structures or buildings due to contractual activities.
2. Repair or replace damaged structures or buildings in a timely fashion and to the satisfaction of the property owner and Owner and at no cost to property owner or Owner.

B. Contractor’s Responsibilities:
1. Contractor will be held responsible for damage to structures or buildings due to contractual activities.
2. Repair or replace damaged structures or buildings in a timely fashion and to the satisfaction of the property owner and Owner and at no cost to property owner or Owner.

C. Measuring and Reporting: By Contractor.

1.5 SEQUENCING AND SCHEDULING

A. Install monitoring systems and take initial readings prior to commencement of construction activities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials and workmanship shall conform to the requirements of other Sections of the Specifications.
1. Where no materials are specified in these specifications, use materials of an equivalent type, quality, and size to match those existing in other areas of the facility.
2. If none exist, use materials and workmanship recognized as of the highest quality in the industry.
3. Obtain Architect’s review of all such material and workmanship.

B. Settlement Markers: Stainless steel nails or stainless steel screw anchors.

C. Crack Monitors:
1. Avongard Calibrated Crack Monitors; or approved equal.
2. Capable of measuring crack displacement and rotation to 1 mm.
3. May include use of steel pins or other appropriate devices driven or grouted into concrete.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Preconstruction Survey:
   1. Conducted by Contractor and witnessed by Architect following award of Contract and before beginning construction.
   2. At Contractor’s expense and documented by Contractor in the form of:
      a. Pictures.
      b. Field notes.
   3. Include an assessment of existing structural conditions and documentation of cracks as identified by Architect and Contractor.

3.2 INSTALLATION AND MONITORING

A. Crack Monitoring:
   1. For bidding purposes, make provisions for 5 crack monitors at locations to be identified by Architect following the preconstruction survey to be conducted by Contractor.
   2. Monitor crack monitors as follows:
      a. Daily for 1 week prior to beginning activities that may affect cracks.
      b. Daily during activities that may affect cracks.
      c. Daily for 1 week after completion of activities that may affect cracks.
   3. At end of construction, remove monitors and repair surfaces to match existing.

3.3 CLEANING

A. Clean materials installed under this Section in accordance with Division 01 Section "Cleaning and Waste Management."

END OF SECTION 01 71 36
SECTION 01 73 29 – CUTTING AND PATCHING

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 provisions for cutting and patching work.

B. Requirements:
   1. Cutting and patching may be described in various Sections of these Specifications
   2. Execute cutting or patching of work required to:
      a. Make several parts fit properly.
      b. Uncover work to provide for installation of ill-timed work.
      c. Remove and replace defective work.
      d. Remove and replace work not conforming to the requirements of the Contract Documents.
      e. Remove Samples of the installed work as specified for testing.
      f. Install specified work in existing construction.

C. Requirements Upon Architect/Engineer's Instructions:
   1. In addition to Contract requirements, upon written instruction of Architect/Engineer:
      a. Uncover work to provide for Architect/Engineer's observation of covered work.
      b. Remove Samples of installed materials for testing.
      c. Remove work to provide for alteration of existing work.

D. Protection of Work:
   1. Do not endanger any work by cutting or altering the work or any part of it.
   2. Do not cut or alter the work of another trade without written consent of Architect/Engineer.

1.3 SUBMITTALS

A. Written Notice:
   1. Prior to cutting which may affect the structural integrity of the Project or the work of another trade, submit written notice to Architect/Engineer and Owner requesting consent to proceed with cutting.
   2. Required Information:
      a. Identification of Project.
      b. Description of all related defective work.
      c. Necessity for cutting.
      d. Affect on other work or on the structural integrity of the Project.
      e. Description of the proposed work including:
         1) Scope of cutting and patching.
         2) Subcontractor and trades to execute work.
         3) Products proposed to be used.
         4) Extent of refinishing.
      f. Alternatives to cutting and patching.
      g. Designation of party responsible for the cost of cutting and patching.

B. Changes of Materials or Methods:
   1. Should conditions of the Work, or the schedule, indicate change of materials or methods, submit a written recommendation to Architect/Engineer including:
      a. Conditions indicating the change.
      b. Recommendations for alternative materials or methods.
      c. Submittals as required for substitutions.
C. Uncovered Work: Submit written notice to Architect/Engineer’s designating the time work will be uncovered to provide for observation.

1.4 DIVISION OF WORK

A. Work:
   1. In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the work to be performed by specific trades.
   2. The following are suggestions as to how the Work may be divided. This is not a complete list of all the Work:
      a. Each trade shall be financially responsible for all cutting and patching for sleeves, penetrations and installation of isolated components as necessary for its work unless herein specifically stated to the contrary.
      b. On renovation projects, Contractor shall cut and patch walls, floors, ceilings to allow for continuous runs of recessed utilities and ductwork.
      c. All patching shall be done by the trade whose work is damaged.
      d. Any cost caused by defective or ill-timed work shall be borne by the party responsible.
      e. Each trade shall do all fitting of its own work as required to make its several components fit together or to receive the work of other contractors.
      f. Holes cut in exterior walls or roofs for installation of mechanical or electrical equipment shall be waterproofed. If existing roofing is to remain, obtain and submit to Owner original roofing manufacturer's approval and warranty on new roof penetrations and where removing existing roof penetrations and curbs.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials and workmanship shall conform to the requirements of other Sections of the Specifications. Where no materials are specified in these specifications, use materials of an equivalent type, quality, and size to match those existing in other areas of the facility. If none exist, use materials and workmanship recognized as of the highest quality in the industry. Obtain Architect/Engineer’s review of all such material and workmanship.

PART 3 - EXECUTION

3.1 INSPECTION

A. Existing Conditions: Inspect existing conditions of the Work, including elements subject to movement or damage during cutting and patching or excavating and backfilling.

B. Uncovered Work: After uncovering work, inspect conditions affecting the installation of new Products.

3.2 PREPARATION

A. Shoring and Bracing: Provide shoring, bracing and support as required to maintain structural integrity of the Project.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

3.3 PERFORMANCE

A. Adjustments to Products: Execute fitting and adjustments of Products to provide finished installation.
B. Refinishing:
   1. Prepare existing surfaces for finishes by scraping, sanding, filling, acid etching, and sand blasting to ensure bonding and a smooth finish.
   2. Refinish entire surfaces as necessary to provide an even finish.
   3. Refinish continuous surfaces to the nearest intersection.
   4. Refinish entire assemblies.

C. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

D. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
   1. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
      a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

3.4 CLEANING

A. Clean materials installed under this Section in accordance with Division 01 Section “Cleaning and Waste Management.”

END OF SECTION 01 73 29
SECTION 01 74 00 – CLEANING AND WASTE MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes provisions for maintaining structures in a standard of cleanliness.

B. Related Sections: In addition to standards described in this Section, comply with requirements for cleaning as described in various other Sections of these Specifications.

1.3 QUALITY ASSURANCE

A. Inspection:
   1. Daily and more often if necessary.
   2. Conduct inspections to verify that requirements of cleanliness are being met.

1.4 DELIVERY, STORAGE AND HANDLING

A. Hazards Control:
   1. Volatile Wastes:
      a. Store in covered metal containers.
      b. Remove from premises daily.
      c. Provide secondary containment for storage of hazardous materials, as required by Owner, governing authorities and agencies.
   2. Prevent accumulation of wastes which create hazardous conditions.
   3. Provide adequate ventilation during use of volatile or noxious substances.

1.5 PROJECT CONDITIONS

A. Cleaning and Disposal:
   1. Conduct operations to comply with local ordinances and anti-pollution laws.
   2. Not Allowed:
      a. Burning or burying of rubbish or waste materials on Site.
      b. Disposal of volatile wastes in storm or sanitary sewers: Volatile wastes include, but are not limited to, mineral spirits, oil and paint thinner.
      c. Disposal of wastes into streams or waterways.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Compatibility:
   1. Compatible with the surface being cleaned.
   2. Recommended by the Manufacturer of the material being cleaned.
   3. As reviewed by Architect/Engineer.
PART 3 - EXECUTION

3.1 PROGRESS CLEANING

A. General:
   1. Store Materials:
      a. In an orderly arrangement allowing maximum access.
      b. Provide for the required protection of materials.
   2. Do not allow accumulation of scrap, debris, waste material and other items not required for construction of the Work.
      a. Provide adequate storage for materials awaiting removal.
   3. Observe requirements for fire protection and protection of the environment.

B. Buildings and Other Structures:
   1. Weekly, and more often if necessary:
      a. Inspect.
      b. Pick up scrap, debris and waste material; remove such items to the place designated for their storage.
      c. Sweep interior spaces clean. Clean shall be defined to be free from dust and other material capable of being removed by reasonable diligence using a hand-held broom.
   2. Preparation for installation of succeeding material:
      a. Clean the building or other structure or pertinent portion thereof:
         1) To the degree of cleanliness recommended by the Manufacturer of the succeeding material.
         2) Using equipment and materials required to achieve the required cleanliness.
   3. After installation of finish floor material:
      a. Clean the finish floor daily at all times while work is being performed in the space in which finish materials have been installed.
         1) Clean as used above shall be defined to be free from all foreign material which, in the opinion of Architect/Engineer, may be injurious to the finish floor material.
   4. Schedule cleaning operations so that dust and other contaminants resulting from cleaning operations will not fall on wet, recently painted surfaces.

3.2 FINAL CLEANING

A. Definitions for Clean: The level of cleanliness generally provided by commercial building maintenance subcontractors using commercial quality building maintenance equipment and materials.

B. Prior to Completion of the Work:
   1. Remove from the Site all tools, surplus materials, equipment, scrap, debris and waste.
   2. Conduct final progress cleaning as described in Article 3.1 above.

C. Project Areas, Adjacent Spaces, and General Building Areas:
   1. Interior:
      a. Visually inspect interior surfaces.
      b. Remove traces of soil, waste material, smudges and other foreign matter.
      c. Remove traces of splashed materials from adjacent surfaces.
      d. Remove paint droppings, spots, stains and dirt from finished surfaces using only the specified cleaning materials and equipment.
   2. Glass: Clean glass inside and outside.
   3. Polished Surfaces: To surfaces requiring the routine application of buffed polish, apply the specified polish as recommended by the Manufacturer of the material being polished.

D. Timing: Schedule final cleaning as approved by Owner to enable Owner to accept a completely clean Project.
3.3 OWNER OCCUPANCY PRIOR TO SUBSTANTIAL COMPLETION AND ACCEPTANCE

A. If Owner occupies the Work, or a portion of the Work, prior to Substantial Completion and acceptance, then the responsibilities for interim and final cleaning shall be determined by Architect in accordance with the Contract Documents.

END OF SECTION 01 74 00
SECTION 01 75 00 – STARTING AND ADJUSTING

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 provisions for the facility start-up and demonstration of the systems as follows:
   1. Equipment.
   2. Mechanical systems.

1.3 SUBMITTALS

A. Preliminary Schedules:
   1. Submit 2 weeks prior to earliest proposed date.
   2. List time and date for the following for each system:
      a. Start-up.
      b. Demonstration to Owner's representative.

B. Completion Reports:
   1. Submit within 1 week after each system demonstration.
   2. List time, date and persons present for the following for each system:
      a. Start-up.
      b. Demonstration to Owner's representative.
   3. Include Manufacturer's representative's report indicating:
      a. Approval of installation.
      b. Satisfactory start-up.
      c. Functioning correctly.
   4. Indicate that demonstration and instructions were satisfactorily completed.

1.4 QUALITY CONTROL

A. Manufacturer's Field Services:
   1. Provide when required by individual Section.
   2. Provide the following services except where indicated otherwise in individual Sections.
      a. Inspect, check and approve system installation.
      b. Supervise system start-up.
      c. Provide written report indicating that system:
         1) Has been properly installed and lubricated.
         2) Is in accurate alignment.
         3) Is free from undue stress imposed by connecting lines or anchor bolts.
         4) Has been satisfactorily operated under full load conditions.
      d. Demonstrate operation of system to the Owner's personnel.
      e. Instruct the Owner's personnel on operation and maintenance of system.

1.5 PROJECT CONDITIONS

A. Verify that:
   1. Excess packing and shipping bolts have been removed.
   2. Interdependent systems have been checked and are operational.
1.6 CORRECTION PERIOD

A. Provide periodic continuing warranty services as necessary to ensure proper functioning of mechanical systems after occupancy of the Project, and for a period of 1 year after date of Substantial Completion.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 STARTING OF SYSTEMS

A. Inspection:
   1. Verify that Project conditions comply with requirements.
   2. Verify that status of Work meets requirements for starting of systems.

B. Preparation:
   1. Coordinate sequence for start-up of various systems including Owner-provided equipment if any.
   2. Notify the Architect 7 days prior to start-up of each system.
   3. Have at hand during entire start-up process:
      b. Shop Drawings.
      c. Product Data.
      d. Operation and Maintenance Data.
   4. Verify that each piece of equipment has been checked for:
      a. Proper lubrication.
      b. Drive rotation.
      c. Belt tension.
      d. Control sequence.
      e. Other conditions which may cause damage.
   5. Verify control systems are fully operational in automatic mode.
   6. Verify that tests, meter readings and specific electrical characteristics agree with those specified by electrical equipment Manufacturer.

7. Bearings:
   a. Inspect for cleanliness, clean and remove foreign materials.
   b. Verify alignment.
   c. Replace defective bearings and those which run rough or noisy.
   d. Grease as necessary and in accordance with Manufacturer's recommendations.

8. Drives:
   a. Adjust tension in V-belt drives, and adjust vari-pitch sheaves and drives for proper equipment speed.
   b. Adjust drives for alignment of sheaves and V-belts.
   c. Clean, remove foreign materials before starting operation.

9. Motors:
   a. Check each motor for amperage comparison to nameplate value.
   b. Correct conditions which produce excessive current flow and which exist due to equipment malfunction.

10. Pumps:
    a. Check mechanical seals for cleanliness and adjustment before running pump.
    b. Inspect shaft sleeves for scoring.
    c. Inspect mechanical faces, chambers and seal rings; replace if defective.
    d. Verify that piping system is free of dirt and scale before circulating liquid through the pump.
    e. Check Pump Performance:
       1) Install a pressure gage on the discharge side of the check valve following pump.
       2) Operate the pump at all system operating heads
          a) Verify pump operation with the Manufacturer's pump curve.
          b) Report deviations to the Architect.
3) Operate the pump through several cycles while observing the pressure gage.
   a) Watch pressure gage for several minutes after pump shut down.
   b) Report significant pressure variations to the Architect.
4) Remove pressure gage and plug tap.

11. Control Valves:
   a. Inspect both hand and automatic control valves; clean bonnets and stems.
   b. Tighten packing glands to ensure no leakage, but permit valve stems to operate without galling.
   c. Replace packing in valves to retain maximum adjustment after system is judged complete.
   d. Replace packing on any valve which continues to leak.
   e. Remove and repair bonnets which leak.
   f. Coat packing gland threads and valve stems with a surface preparation of "Moly-Cote" or "Fel-Pro" after cleaning.
   g. Verify that control valve seats are free from foreign material and are properly positioned for intended service.

12. Flanges:
   a. Tighten flanges after system has been placed in operation.
   b. Replace flange gaskets which show any sign of leakage after tightening.

13. Screwsed Joints:
   a. Inspect screwed joints for leakage.
   b. Promptly remake each joint which appears to be faulty; do not wait for rust to form.
   c. Clean threads on both parts, apply compound and remake joints.

14. Cleaning:
   a. After system has been placed in operation, clean strainers, dirt pockets, orifices, valve seats and headers in fluid systems, to ensure being free of foreign materials.
   b. Open steam traps and air vents: remove operating elements. Clean thoroughly, replace internal parts, and put back into operation.
   c. Remove rust, scale and foreign materials from equipment and renew defaced surfaces.

15. Draft Gages: Set and calibrate draft gages of air filters and other equipment.

16. Fan Wheels:
   a. Inspect fan wheels for clearance and balance.
   b. Provide factory-authorized personnel for adjustment when needed.

17. Control Circuits:
   a. Check each electrical control circuit to ensure that operation complies with Specifications and requirements to provide desired performance.

18. Pressure gages:
   a. Inspect each pressure gage and thermometer for calibration.
   b. Replace items which are defaced, broken or which read incorrectly.

19. Repair damaged insulation.

20. Venting and drainage:
   a. Vent gases trapped in any part of systems.
   b. Verify that liquids are drained from all parts of gas or air systems.

21. Leaks: Check piping for leaks at every joint and at every screwed, flanged or welded connection using "Leak-Tek" or other approved compound.

C. Start-up:
   1. Execute start-up under supervision of responsible persons in accordance with Manufacturer's instructions.
   2. Place equipment in operation in proper sequence.

3.2 SYSTEMS DEMONSTRATION

A. Preparation:
   1. Verify That System:
      a. Has been inspected and put in service.
      b. Is fully operational.
   2. Operation and Maintenance Manuals:
      a. Completed.
      b. Sufficient copies available for use in demonstrations and instructions.
B. Demonstrations and Instructions:
   1. Demonstration Of and Instruction On Operation and Maintenance of System:
      a. To the Owner's personnel.
      b. Two weeks prior to Substantial Completion.
   2. Equipment Requiring Seasonal Operation: Demonstrate within 6 months of Substantial Completion.
   3. Instruction:
      a. Operation and maintenance manual as basis.
      b. Review contents of manual in detail.
      c. Explain all aspects of operation and maintenance.
   4. Demonstrate:
      a. Start-up.
      b. Operation.
      c. Control.
      d. Adjustment.
      e. Troubleshooting.
      f. Servicing.
      g. Maintenance.
      h. Shutdown.

3.3 PERFORMANCE TEST

A. Performance Test:
   1. Test the entire Work, including all of its individual systems for 2 weeks before final payment will be made.
   2. Make final tests in the presence of the Owner and the Architect.
   3. If any part of the Work or equipment does not meet Specifications:
      a. Correct the situation.
      b. Obtain approval of the Architect before final payment is made.
   4. Provide the personnel and bear all costs for correcting all malfunctions.
   5. The Owner will provide operating personnel and utilities.

END OF SECTION 01 75 00
 SECTION 01 77 00 – CLOSEOUT PROCEDURES

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 instructions for and the responsibilities of each party in contract closeout.

B. Related Section includes Certificate of Substantial Completion.

1.3 SUBSTANTIAL COMPLETION

A. Contractor: When Contractor considers that the Work or any portion of the Work is ready for its intended use, Contractor shall submit:
   1. Written certification to Architect/Engineer and Owner that the Work, or designated portion of the Work, is substantially complete.
   2. A list of major items to be completed or corrected.
   3. Request that Architect/Engineer issue a certificate of Substantial Completion.

B. Architect/Engineer's Inspection: Architect/Engineer will make an inspection:
   1. Within 10 full working days after receipt of request, or on a date mutually agreed upon with all attendees.
   2. Together with Owner and Contractor.

C. Architect/Engineer's Determination of Substantial Completion:
   1. Should Architect/Engineer consider the Work or designated portion of the Work substantially complete, the following steps shall be taken:
      a. Contractor shall prepare and submit to Architect/Engineer, a list of items to be completed or corrected as determined by the inspection.
      b. Architect/Engineer will prepare and deliver to Owner:
         1) A tentative certificate of Substantial Completion.
         2) A tentative list of items to be completed or corrected before final payment.
      c. Owner shall have 7 full working days after receipt of the tentative certificate during which to make written objection to Architect/Engineer as to any provisions of the certificate or attached list.
      d. Architect/Engineer will, within 14 full working days after delivery of tentative certificate to Owner, decide:
         1) Not Substantially Complete: Architect/Engineer will issue written notice to Contractor stating reasons.
         2) Substantially Complete: Architect/Engineer will issue definitive certificate of Substantial Completion and a revised list of items to be corrected or completed.

   2. Should Architect/Engineer consider that the Work or designated portion of the Work is not substantially complete, the following steps shall be taken:
      a. Architect/Engineer shall notify Contractor in writing stating Architect/Engineer's reasons.
      b. Contractor shall complete the Work and send a second written notice to Architect/Engineer certifying that the Project, or designated portion of the Project, is substantially complete.
      c. Architect/Engineer and Owner will reinspect the Work.

D. Division of Responsibilities:
   1. Architect/Engineer:
      a. At the time of delivery of tentative certificate of Substantial Completion.
      b. Deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment with respect to:
         1) Security.
         2) Operation.
3) Safety.
4) Protection of the Work.
5) Maintenance.
6) Heat.
7) Utilities.
8) Insurance.
9) Warranties.

2. Architect/Engineer's written recommendation on division of responsibilities shall be binding on Owner and Contractor until final payment unless Owner and Contractor agree otherwise in writing and so notify Architect prior to Architect's issuance of a definitive certificate of Substantial Completion.

1.4 FINAL INSPECTION

A. Contractor Certification: Prior to final inspection, Contractor shall submit written certification that:
   1. The Contract Documents have been reviewed.
   2. The Project has been inspected in compliance with the Contract Documents.
   3. Work has been completed in accordance with the Contract Documents.
   4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
   5. The Project is complete and ready for final inspection.

B. Architect/Engineer's Inspection: The Architect/Engineer will make final inspection:
   1. Within 10 full working days after receipt of certification.
   2. Together with Owner and Contractor.

C. Architect/Engineer's Determination of Final Completion:
   1. Should Architect/Engineer consider the Work complete and ready for final payment in accordance with the requirements of the Contract Documents, Architect/Engineer shall request Contractor to make Project closeout submittals.
   2. Should Architect/Engineer consider the Work not complete and ready for final payment:
      a. Architect/Engineer shall notify Contractor in writing stating the reasons.
      b. Contractor:
         1) Take immediate steps to remedy the stated deficiencies.
         2) Send a second written notice to Architect/Engineer certifying that the Work is complete.
      c. Architect/Engineer and Owner will reinspect the Work.

1.5 REINSPECTION COSTS

A. Should Architect/Engineer be required to perform second inspections because of failure of the Work to comply with the original certifications of Contractor, Owner will compensate Architect/Engineer for additional services and deduct the amount paid from payment or payments to Contractor, according to the Preferred Vendor agreement.

1.6 ADDITIONAL INSPECTION COSTS

A. Substantial Completion: Owner will compensate Architect/Engineer for inspection services rendered between the scheduled date of Substantial Completion and the actual date of Substantial Completion and deduct the amounts paid from payment or payments to Contractor.

B. Final Completion: Owner will compensate Architect/Engineer for inspection services rendered between the scheduled date of final completion and the actual date of final completion and deduct the amounts paid from payment or payments to Contractor.
1.7 CLOSEOUT SUBMITTALS

A. Contractor:
1. Provide closeout submittals as required in the Contract Documents.
2. These submittals shall include, but not necessarily be limited to:
   a. Project record documents.
   b. Operation and maintenance manuals.
   c. Guarantees.
   d. Spare parts and maintenance materials.
   e. Instruction in operation of all systems.
      1) Record all training per WSU standards and create DVD. Provide two copies with close-out documentation.

1.8 EVIDENCE OF PAYMENTS AND RELEASE OF LIENS

A. Affidavits:
1. Submit with final Application for Payment an affidavit of payment of debts and release of claims.
2. Affidavit shall include:
   a. Contractor's release or waiver of lien.
   b. Consent of surety of final payment.
   c. Separate releases or waivers of liens for Subcontractors, Suppliers and others with lien rights against property of Owner together with a list of those parties.

B. Execution: All submittals shall be duly executed before delivery to Architect/Engineer.

1.9 FINAL ADJUSTMENT OF ACCOUNTS

A. Final Statement: Submit a final statement of accounting, which reflects all adjustments, to Architect/Engineer.
   This statement shall contain the following:
   2. Additions and deductions.
   3. Total Contract Price as adjusted.
   4. Previous payments.
   5. Sum remaining due.

B. Final Change Order: Architect may prepare a final Change Order reflecting approved adjustments to the Contract Price not previously made by Change Orders.

1.10 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit a final Application for Payment in accordance with the requirements of the Contract Documents.

B. Disposition of Final Application for Payment:
   1. If the final Application for Payment and the Work are acceptable in accordance with the Contract Documents:
      a. Architect/Engineer, within 10 full working days after receipt of the Application for Payment:
         1) Submit to Owner a written recommendation for payment.
         2) Submit to Owner and Contractor a written notice that the Work is acceptable subject to the provisions of the General Conditions.
      b. Owner will, within 30 calendar days after receipt of the Application for Payment and Architect/Engineer's recommendation in accordance with the Contract Documents, pay to Contractor the amount recommended.
   2. If the Application for Payment, the Work or both are unacceptable:
      a. Architect/Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment.
      b. Contractor shall make the necessary corrections and resubmit the Application for Payment.
3. Final Completion Delayed:
   a. Upon receipt of Contractor’s final Application for Payment and recommendation by Architect/Engineer, Owner shall make payment of the balance due for that portion of the Work fully completed and accepted if Architect/Engineer confirms that final completion of the Work is significantly delayed through no fault of Contractor.
   b. Payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.
   c. Contractor shall submit with the Application for Payment written consent of surety if the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 77 00
SECTION 01 78 39 – PROJECT RECORD DOCUMENTS

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 procedures for the maintenance, recording and submittal of Project record documents.

1.3 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Storage:
1. Store documents and Samples in Contractor's field office apart from documents used for construction.
2. Provide files and racks for storage of documents.
3. Provide locked cabinet or secure storage space for storage of Samples.

B. Filing: File record documents in accordance with CSI Masterformat.

C. Maintenance:
1. Maintain documents in a clean, dry, legible condition and in good order.
2. Do not use record documents for construction purposes.

D. Availability: Make documents and Samples available at all times for inspection by Architect.
1. Reviewed submittals and shop drawings to be maintained on a FTP site accessible to project team members.

1.4 RECORDING

A. Labeling: Label each document "PROJECT RECORD" in neat large printed letters.

B. Recording:
1. Record actual revisions to the Work.
2. Record information concurrently with construction progress.
3. Do not conceal any work until required information is recorded.

C. Drawings:
1. Legibly mark, with notes or graphic representations, to record actual construction.
   a. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
   b. Field changes of dimension and detail.
   c. Changes made by Field Order, Work Change Directive or Change Order.
   d. Details not on original Contract Drawings.
2. After Architect/Engineer's review of the record drawings, transfer all marks to electronic documents provided by Architect/Engineer.

D. Specifications and Addenda:
1. Legibly mark each Section to record:
   a. Manufacturer, trade name, catalog number, and Supplier of each Product and item of equipment actually installed.
   b. Changes made by Field Order, Work Change Directive or Change Order.
1.5 SUBMITTAL

A. Delivery: At Contract closeout, deliver record documents to Architect/Engineer for Owner.
   1. Provide electronic as well as 3 hard copies.
   2. Provide two copies of DVDs recorded of all training per WSU standards.

B. Transmittal Letter:
   1. Accompany submittal with transmittal letter in duplicate, containing:
      a. Date.
      b. Project title and number.
      c. Contractor's name and address.
      d. Title and number of each Record Document.
      e. Signature of Contractor or their authorized representative.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 78 39
SECTION 02 41 19 – SELECTIVE DEMOLITION

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 modification, alteration, conversion, and renovation of existing structures:
   1. Be aware of the many incidental items which exist which must be demolished, relocated, or replaced in order to accomplish the remodeling work of trades.
   2. Include the price of such demolition, relocating, and replacement in the base Bid.
   3. These incidental items may or may not be indicated in the Contract Documents.
   4. Contractor and Subcontractors performing remodeling work are expected to be familiar with the unknown nature of existing utilities serving an area to be remodeled and shall calculate the base Bid to include the demolition, removal, relocation, and replacement of these utilities.
   5. Contractor to perform a walk-through with the Owner to review any requested salvaged items prior to demolition.
   6. The Owner will perform testing for asbestos containing materials and perform any necessary abatement prior to the start of construction.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the pertinent provisions of the following:
   2. ASTM: D1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort.

1.4 DEFINITIONS

A. Terms:
   1. Abandon:
      a. Remove an item to the extent that it is not visible and does not interfere with new construction.
      b. Portions of the abandoned item may be left in place.
      c. No abandoned items shall be left below new footings.
   2. Demolish:
      a. Remove existing items from their present location in the Project area and haul to an area outside of the Project area.
      b. Remove utilities serving these items.
   3. Relocate:
      a. Move existing items from their present location to another location in the Project area.
      b. Extend utilities serving the present location to the new location.
   4. Remove:
      a. Except for items indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner’s property, demolished materials shall become Contractor’s property.
      b. Remove existing items from their present location in the Project area and haul to an area outside of the Project area.
      c. Remove utilities serving these items.
   5. Replace:
      a. Remove existing items from their present location in the Project area, haul them to an area outside of the Project area, and furnish and install new items in the same or another location.
      b. Extend utilities serving the present location to the new location.
6. Reuse: Move existing items from their present location to another location in the Project area. Extend utilities serving the present location to the new location.

1.5 DIVISION OF WORK

A. Work: In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the work to be performed by specific trades. The following are suggestions as to how the Work may be divided. This is not a complete list of the work:

1. Contractor:
   a. Cut and patch walls, floors, and ceilings to allow for recessed utilities and ductwork.
   b. Remove and reinstall existing suspended ceilings to allow for above ceiling construction.
   c. Replace damaged units.
   d. Install new ceilings as indicated on the Drawings.
   e. Place sleeves in new concrete structures.
   f. Install fire stop and smoke stop systems at penetrations for ratings indicated in accordance with local building codes.

2. Mechanical, Electrical, and Fire Protection Subcontractors:
   b. Install fire stop and smoke stop systems at utility penetrations in accordance with local building codes.
   c. Furnish and install sleeves in gypsum board and masonry construction.
   d. Core drill existing concrete for new utilities and sleeves after obtaining Architect’s review of locations.
   e. Remove and reinstall existing fire protection heads to allow for ceiling removal and installation.
   f. Furnish new heads, piping, and connections as required for completion of the Work.

3. Miscellaneous:
   a. Each trade shall be financially responsible for cutting and patching for sleeves, penetrations, and installation of isolated components as necessary for its work unless herein specifically stated to the contrary.
   b. On renovation projects, cut and patch walls, floors, and ceilings to allow for continuous runs of recessed utilities and ductwork.
   c. Patching shall be done by the trade whose work is damaged.
   d. Costs caused by defective or ill-timed work shall be borne by the party responsible.
   e. Each trade shall do fitting of its own work as required to make its several components fit together or to receive the work of other trades.

1.6 QUALITY ASSURANCE

A. Qualifications: Engage an experienced firm that has specialized in demolition work similar to material and extent indicated for this Project.

B. Regulatory Requirements:
   1. Comply with governing EPA notification regulations before beginning selective demolition.
   2. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Pre-Demolition Conference:
   1. Conduct pre-demolition conference at Site in accordance with in Division 01 Section “Project Meetings.”
   2. Review methods and procedures related to selective demolition including, but not limited to, the following:
      a. Inspect and discuss condition of construction to be selectively demolished.
      b. Review structural load limitations of existing structure.
      c. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and to avoid delays.
      d. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
1.7 PROJECT CONDITIONS

A. Owner Occupancy:
1. Owner will occupy portions of building immediately adjacent to selective demolition area.
2. Conduct selective demolition so Owner's operations will not be disrupted.
3. Provide not less than 72 hours notice to Owner of activities that will affect Owner's operations.

B. Access:
1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
2. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.

C. Conditions:
1. Owner and Architect assume no responsibility for condition of areas to be selectively demolished.
2. Conditions existing at time of inspection for bidding purposes will be maintained by Owner as far as practicable.
3. Before selective demolition begins, Owner will remove the following items:
   a. Furnishings and fixtures.
   b. Movable equipment.

D. Storage or sale of removed items or materials on Site will not be permitted.

E. Maintenance of Utilities:
1. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
2. Maintain fire-protection facilities in service during selective demolition operations.

F. Known Hazardous Materials:
1. The Owner has tested for hazardous materials and they are present in building to be selectively demolished.
2. Hazardous materials remediation is the responsibility of the Owner.
3. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.

1.8 WARRANTIES

A. Existing Warranties:
1. 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.
2. If possible, retain original installer or fabricator to patch exposed work that is damaged during selective demolition.
3. If it is not possible to engage original installer or fabricator, engage another recognized, experienced, and specialized firm.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:
1. Materials and workmanship shall conform to the requirements of other Sections of the Specifications.
2. Where no materials are specified in these specifications, use materials of an equivalent type, quality, and size to match those existing in other areas of the facility.
3. If none exist, use materials and workmanship recognized as of the highest quality in the industry.
4. Obtain Architect's review of such material and workmanship.

B. Piping: Existing piping which is removed from its present location shall not be reused where new piping is required unless specifically noted on the Drawings.
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 of items to be removed and salvaged.

D. Conflicts:
   1. 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.
   2. Promptly submit written report to Engineer.

E. Survey, or engage a competent person to survey condition of the building, in accordance with requirements of OSHA, to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during selective demolition operations.

F. Perform additional surveys as the work progresses to detect hazards resulting from operations to date.

3.2 UTILITY SERVICES

A. Maintain existing services indicated to remain and protect them against damage during selective demolition operations.

B. Interruptions:
   1. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and other authorities having jurisdiction.
   2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.
   3. Provide at least 72 hours notice to Owner if shutdown of service is required during changeover.

C. Utility Requirements:
   1. Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.
   2. Owner will arrange to shut off indicated utilities when requested by Contractor.
   3. Arrange to shut off indicated utilities with utility companies.
   4. If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition, provide temporary utilities that bypass areas of selective demolition and that maintain continuity of service to other parts of building.
   5. Cut off pipe or conduit in walls or partitions to be removed.
   6. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

3.3 PREPARATION

A. Dangerous Materials: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

B. Site Access and Temporary Controls:
   1. Conduct selective demolition and debris removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   2. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and other authorities having jurisdiction.
   3. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
   4. Erect temporary walls for protection and separation where required by authorities having jurisdiction.
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C. Temporary Facilities:
   1. Protection:
      a. Provide temporary barricades and other protection required to prevent injury to people and
damage to adjacent areas.
      b. Provide protection to ensure safe passage of people around selective demolition area, and to and
from occupied portion of building.
      c. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed
during selective demolition operations.
      d. Cover and protect furniture, furnishings, and equipment that have not been removed.
   2. Shoring and Bracing:
      a. Provide and maintain shoring, bracing, or structural support to preserve stability and prevent
movement, settlement, or collapse of construction to remain, and to prevent unexpected or
uncontrolled movement or collapse of construction being demolished.
      b. Strengthen or add new supports when required during progress of selected demolition.

3.4 POLLUTION CONTROLS

A. Dust Control:
   1. Use water mist, temporary closures, and other suitable methods to limit spread of dust and dirt.
   2. Do not use water when it may damage existing construction or create hazardous or objectionable
conditions, such as ice, flooding, and pollution.
   3. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure.
   4. Vacuum carpeted areas.
   5. Comply with governing environmental protection regulations.

B. Disposal:
   1. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   2. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris
to grade level in a controlled descent.

3.5 GENERAL

A. Demolish and remove existing construction only to the extent required by new construction and as indicated.

B. Burn permit required by WSU Office of Risk Management in advance of any burning, grinding, (etc) work.

C. Methods:
   1. Use methods required to complete the work within limitations of governing regulations.
   2. Level by Level:
      a. Proceed with selective demolition systematically, from higher to lower level.
      b. Complete selective demolition operations above each floor or tier before disturbing supporting
members on the next lower level.
   3. Cutting Openings:
      a. Neatly cut openings and holes plumb, square, and true to dimensions required.
      b. Use cutting methods least likely to damage construction to remain or to adjoining construction.
      c. Use hand tools or small power tools designed for sawing or grinding, not hammering and
chopping, to minimize disturbance of adjacent surfaces.
      d. Temporarily cover openings to remain.
   4. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished
surfaces.
   5. Flame Cutting:
      a. Do not use cutting torches until work area is cleared of flammable materials.
      b. At concealed spaces, such as duct and pipe chases, verify condition and contents of hidden space
before starting flame-cutting operations.
      c. Maintain fire watch and portable fire suppression devices during flame-cutting operations.
      d. Maintain adequate ventilation when using cutting torches.
   6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials, and promptly and
legally dispose of off Site.
   7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive
loads on supporting walls, floors, or framing.
8. Dispose of demolished items and materials promptly.
9. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.

D. Existing Facilities: Comply with Owner’s requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during the selective demolition operations.

E. Removed and Salvaged Items:
1. Clean salvaged items.
2. Pack or crate items after cleaning and 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.

F. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
2. Paint equipment to match new equipment.
3. Pack or crate items after cleaning and repairing, and identify contents of containers.
4. Protect items from damage during transport and storage.
5. Reinstall items in locations indicated.
6. Comply with requirements for new materials and equipment.
7. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

G. Existing Items to Remain:
1. Protect construction indicated to remain against damage and soiling during selective demolition.
2. When permitted by Architect, items may be removed to a suitable, protected storage location and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 DEMOLITION

A. Structures:
1. Cut, repair, reuse, excavate, demolish or otherwise remove parts of the existing structures or appurtenances, as indicated on the Drawings, herein specified and necessary to permit completion of the Work.
2. Dispose of demolished materials in an approved manner.
3. Include necessary cutting, bending, and welding of reinforcing steel, structural steel, or miscellaneous metal work found embedded in the existing structures.
4. When removing materials or portions of existing structures, shore up, underpin, and protect adjacent structures.
5. Concrete:
   a. Demolish in small sections.
   b. Cut concrete to a depth of at least 3/4-inch at junctions with construction to remain, using a power driven saw.
   c. Dislodge concrete from reinforcement to remain at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated.
   d. Neatly trim openings to dimensions indicated.
6. Engineer’s review of cutting: No existing structure, equipment or appurtenance shall be shifted, cut, removed or otherwise altered without obtaining review of Engineer.

B. Equipment:
1. Dismantle, remove, and relocate existing equipment, piping, and other appurtenances required for the completion of the Work.
2. Cut existing pipelines for the purpose of making connections thereto.
3. Cut off anchor bolts for equipment and structural steel indicated to be removed 1-inch below the concrete surface.
4. Patch remaining concrete surface to smooth even finish.
5. Remove air conditioning equipment without releasing refrigerants, if applicable.
C. Piping, Fire Protection, and Electrical Components:
1. When a new connection is made to an existing pipeline, install additional new piping, extending to and including the most convenient new valve.
2. Piping, conduit, and wiring indicated or required to be demolished shall be done so to the nearest reasonable connection outside of the Project area or as directed by Engineer.
3. Where necessary or required for the purpose of making connections, cut existing pipelines in a manner to provide an approved joint.
4. Weld beads, flanges, and provide Dresser couplings on existing and new piping.
5. Remove and reinstall existing fire protection heads to allow for new construction.
6. Comply with applicable fire protection codes.
7. Furnish new heads, piping, and connections as required for completion of the Work.
8. Remove junction boxes and electrical outlets which will no longer be in use.
9. At existing walls which are made thicker, extend piping and wiring to accommodate additional wall thickness.
10. Remove and reinstall fixtures and electrical outlets, switches, etc.

D. Ductwork:
1. Remove portions of existing ductwork systems to the nearest branch outside the project area, except as indicated otherwise on drawings.
2. Remove existing ductwork in a manner to minimize dispersion of dust in the duct system.
3. Repair and replace existing insulation and duct liner disturbed by this Work to provide a continuous smooth surface.
4. New connections to existing ductwork shall comply with the requirements of Division 23 Section “Metal Ducts.”

E. Masonry Walls: Where masonry walls are to be removed and replaced, and where filling existing openings, allow for toothing in of the new masonry at alternate courses so that the existing running bond pattern is maintained.

F. Floor Slabs:
1. Where new utilities must be installed below the existing floor slab, saw cut the slab for at least 1-inch of depth.
2. Break out the remaining depth with jack hammers or hand tools to provide a rough surface.
3. Leave existing steel reinforcing so that it laps at least 6 inches into the new concrete slab over the trench.
4. The exact width of the concrete removed shall depend upon the required depth and diameter of the new utility.
5. Allow for sufficient working space in the trench.

G. Conceal Utilities: Recess new piping, conduit, and other utilities into floors, wires, and ceilings in finished areas.

H. Ownership of Salvaged Materials:
1. Materials and equipment removed shall remain the property of Owner at Owner’s option.
2. Items not salvageable, as determined by Architect and Owner, and items Owner elects not to keep shall become the property of Contractor to be properly disposed of off the Site.
3. Salvaged equipment shall be thoroughly cleaned, lubricated, and greased for protection during prolonged storage.

I. Nonshrink Grout: Use nonshrink grout for setting wall castings, sleeves, leveling pump bases, doweling anchors into existing concrete and elsewhere as indicated.

J. Protect Facility from Water Damage: Provide flumes, hoses, piping, suitable plugs, bulkheads, or other means to divert or hold back the flow of wastewater, water, or other liquids, as required for proper performance of the Work.

K. Blasting: Not permitted.
L. Sleeves:
1. Subcontractors for mechanical, electrical, and other trades shall furnish sleeves and inserts for pipes, conduits, and similar items in forms, walls, partitions, and floors.
2. Perform work in cooperation with Contractor.
3. Place items in ample time so as not to delay operations.
4. Do not place sleeves so they pass through beams, girders, and similar construction.

M. Firestopping and Smokestopping: Install firestop and smokestop systems at utility penetrations in accordance with local building codes and Division 07 Section “Penetration Firestopping”.

N. Miscellaneous: At existing walls which are made thicker, reinstall fire extinguisher cabinets, clocks, thermostats, and other wall hung items in new wall to accommodate additional wall thickness.

3.7 PATCHING AND REFINISHING

A. Promptly repair damage to adjacent construction caused by selective demolition operations.

B. Patching:
1. Patch and repair existing surfaces from which items have been removed leaving holes, fasteners, and surface blemishes exposed to view.
2. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
3. Completely fill holes and depressions in existing masonry walls that are to remain with an approved masonry patching material applied according to Manufacturer’s written recommendations.
4. Comply with Division 01 Section “Cutting and Patching.”

C. Refinishing:
1. Prepare existing surfaces for finishes by scraping, sanding, filling, acid etching, and sand blasting to ensure bonding and a smooth finish.
2. Refinish entire surfaces as necessary to provide an even finish.
3. Refinish continuous surfaces to the nearest intersection and entirely finish assemblies.
4. Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.
5. Refinish entire surfaces if necessary to remediate existing lead painted surfaces.

D. Floors and Walls:
1. Where floors or partitions that are demolished extend one finished area into another, patch and repair floor and wall surfaces in the new space.
2. Provide an even surface of uniform finish, color, texture, and appearance.
3. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
4. Patch with durable seams that are as invisible as possible.
5. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
6. Where patching occurs in a painted surface, apply primer and intermediate coats over the patch and apply final coat over entire unbroken surface containing patch.
7. Provide additional coats until patch blends with adjacent surfaces.
8. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

E. Ceilings: Patch, repair, or rehang existing materials as necessary to provide even plane surface of uniform appearance.

3.8 CLEANING

A. Clean materials installed under this Section in accordance with Division 01 Section “Cleaning and Waste Management.”

B. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations.
C. Return adjacent areas to conditions existing before selective demolition operations began.

END OF SECTION 02 41 19
SECTION 02 42 13 - REMOVAL OF EXISTING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes: the removal of existing equipment and all pipe, fittings, valves and appurtenances not required for the proper operation of the project.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 GENERAL

A. Do not proceed with removal of any equipment, piping or appurtenances without specific approval of Engineer. All equipment, piping or appurtenances removed without proper authorization, which is necessary for the operation of the existing facility, shall be replaced to the satisfaction of Engineer at Contractor's expense.

B. All existing tubing, insulation, hangers and supports shall become the property of Contractor immediately upon removal from their present locations. Contractor shall remove such material from the Site at his own expense and it shall not be reused.

C. All existing valves, and other special piping and utility elements, greater than 3-inch diameter, removed shall remain the property of Owner. Contractor shall furnish all labor and material to identify, clean, protect, crate and box and store them at the Site.

D. Provide pieces of equipment weighing 150 pounds or more with suitable skids before storing.

E. Wherever piping is removed, adjacent pipe and headers that are to remain in service shall be blanked off or plugged and then anchored in an approved manner.

F. Equipment to be retained by Owner shall be carefully removed from the present location, cleaned and immediately stored onsite as designated by Owner.

G. Take all necessary precautions against damaging the material and equipment to be stored. Repair all damage resulting from Contractor operations, as directed by and to the satisfaction of Engineer.

H. Give itemized lists of materials removed and stored to Engineer daily. A final typed itemized list shall be furnished to Engineer in 6 copies at the completion of construction. The list shall include items, method of packaging, and place of storage.

3.2 EQUIPMENT TO BE RETAINED

A. The following is a list of items which shall be removed and remain the property of Owner. The list is not intended to be complete, but only to convey the general types of equipment to be retained by Owner:
1. Electric panels and motor control centers.
2. Pumps and drive units.
3. Flow meters.
4. Primary and final settling tank mechanisms.
5. Pipes and valves greater than 3-inch diameter (not including buried pipes and valves).
7. Air compressors.
8. Blowers and motors.

B. All equipment removed shall remain the property of Owner unless designated otherwise by Owner.

C. If Owner elects not to retain ownership of certain items, the items shall be removed from the site and disposed of properly by the Contractor at the Contractor's expense.

END OF SECTION 02 42 13
SECTION 07 84 13 – PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Penetrations in fire-resistance-rated walls.
   2. Penetrations in horizontal assemblies.
   3. Penetrations in smoke barriers.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
   1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

1.5 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:
   1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
      a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
         1) UL in its "Fire Resistance Directory."
         2) Intertek Group in its "Directory of Listed Building Products."
         3) FM Global in its "Building Materials Approval Guide."
2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. 3M Fire Protection Products.
      b. Hilti, Inc.
      c. Tremco, Inc.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
   1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
   1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
   2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
   3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.
   1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.

E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

F. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content:
   1. Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

C. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
D. Install fill materials by proven techniques to produce the following results:
1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
   1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.3 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION 07 84 13
SECTION 07 92 00 – JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Urethane joint sealants.
   2. Mildew-resistant joint sealants.
   3. Latex joint sealants.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint sealant product.
B. Samples: For each kind and color of joint sealant required.
C. Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.
B. Preconstruction laboratory test reports.
C. Preconstruction field-adhesion-test reports.
D. Field-adhesion-test reports.
E. Sample warranties.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
   1. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with glazing and gasket materials.

1.7 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Construction Chemicals - Building Systems; Sonalastic TX1.
      c. ER Systems, an ITW Company; Pacific Polymers Elasto-Thane 230 MP.
      d. Pecora Corporation; Dynatrol I-XL.
      e. Polymeric Systems, Inc.; Flexiprene 1000.
      f. Sika Corporation U.S.; Sikaflex Textured Sealant.
      g. Tremco Incorporated; Dymonic.

2.3 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 786-M White.
      b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.
      c. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; Bondaflex Sil 100 WF.
      d. Soudal USA; RTV GP.
      e. Tremco Incorporated; Tremsil 200.

C. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Construction Chemicals - Building Systems; Sonolac.
      c. Pecora Corporation; AC-20.
      d. Tremco Incorporated; Tremflex 834.

2.4 JOINT-SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. BASF Construction Chemicals - Building Systems.
      b. Construction Foam Products, a division of Nomaco, Inc.
B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.5 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - PRODUCTS

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. Remove laitance and form-release agents from concrete.
   2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

3.2 INSTALLATION OF JOINT SEALANTS

A. General: Comply with ASTM C 1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   1. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
3.3 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Tile control and expansion joints.
      c. Vertical joints on exposed surfaces of unit masonry, concrete, walls, and partitions.
      d. Other joints as indicated on Drawings.
   2. Joint Sealant: Urethane, S, NS, 25, NT.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
   1. Joint Locations:
      a. Control joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.
      c. Other joints as indicated on Drawings.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      b. Tile control and expansion joints where indicated.
      c. Other joints as indicated on Drawings.
   2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Concealed mastic.
   1. Joint Locations:
      a. Aluminum thresholds.
      b. Sill plates.
      c. Other joints as indicated on Drawings.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 92 00
SECTION 08 11 13 – HOLLOW METAL DOORS AND FRAMES

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. Extent of steel doors and frames is indicated on drawings and in schedules.
   B. Types of hollow metal work includes:
      1. Steel doors.
      2. Steel door frames.
      3. Steel window frames.

1.3 SUBMITTALS
   A. Product Data: Mfr’s standard details and specifications for steel doors and door and window frames.
   B. Shop Drawings: Indicate application of products to project.

1.4 QUALITY ASSURANCE
   A. Standards: Comply with Steel Door Institute (SDI-100-91) "Recommended Specifications for Standard Steel Doors and Frames" for materials quality, metal gages, and construction details for Grades and Models indicated in Part 2 of this Section, and shall meet ANSI Grade A requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
   A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
      1. Amweld Building Products, Inc.
      2. Ceco Corp.
      3. Curries Co.
      5. Republic Builders Products

2.2 STEEL DOORS AND FRAMES
   A. Materials: Steel doors and frames; hot-rolled, pickled and oiled per ASTM A 569 and A 568; cold-rolled per ASTM A 366 and A 568.
   B. Steel Doors, General: Provide doors complying with material and construction requirements of ANSI/SDI-100 for the indicated Grades and Models:
      1. Grade II, heavy-duty (Level B); 1-3/4-inch thick; min. 18 gage face sheets.
      2. Model 3, Seamless - Hollow Steel Construction; or Model 4, Seamless - Composite Construction as standard with door manufacturer or to comply with other specified requirements of this Section.
   C. Steel Frames, General: Provide frames complying with material and construction requirements of ANSI/SDI-111A, and as follows:
      1. Metal Thickness: Min. 16 gage.
      2. Type: Welded (masonry walls and partitions).
D. Fire-rated Assemblies: Provide units that are labeled and listed for rating indicated, by Underwriters' Laboratories or Warnock-Hersey.

E. Anchors and Accessories: Manufacturer's standard units. Use galvanized items for units built into exterior walls, complying with ASTM A 153.

2.3 FABRICATION

A. Fabricate units to be rigid, neat in appearance, and free from defects, warp or buckle. Weld exposed joints continuously, grind, dress, and make smooth, flush and invisible.

B. Cut-Outs: Regardless of cut-out locations shown on Drawings, provide flush panel at the bottom 10 inches of each door, in compliance with State of Michigan barrier-free requirements.

C. Prepare steel doors and frames to receive mortised and concealed finish hardware, including cutouts, reinforcing, drilling and tapping, complying with ANSI A 115 "Specifications for Door and Frame Preparation for Hardware".
   1. Prepare frames to receive 3 silencers on strike jambs of single-swing frames and on heads of double-swing frames.
   2. Provide 26-gage steel mortar boxes, welded to frame, at back of hardware cutouts where installed in concrete, masonry or plaster openings.

D. Locate finish hardware per DHI "Recommended Locations for Builder's Hardware".

E. Shop paint exposed surfaces of doors and frame units, including galvanized surfaces, using mfr's standard baked-on rust inhibitive primer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Placing Frames: Comply with provisions of SDI 105, unless otherwise indicated. Set frames, with spreaders, accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
   1. Except for frames located in existing concrete, masonry, or gypsum board assembly construction, place frames before constructing enclosing walls and ceilings.
   2. In masonry construction, install at least 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
   3. At existing concrete or masonry construction, install at least 3 completed opening anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Set frames and secure to adjacent construction with bolts and masonry anchorage devices.
   4. Install fire-rated frames according to NFPA 80.

B. Door Installation: Fit hollow-metal doors accurately in frames, within clearances specified in ANSI/SDI 100.
   1. Fitting Clearances for Non-Rated Doors: Provide 1/8-inch at jambs and heads; 1/16-inch per leaf at meeting stiles for pairs of doors; and 1/2-inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/8-inch clearance from bottom of door to top of threshold.
   2. Fire-Rated Doors: Smoke and draft control door assemblies must be tested in accordance with UL 1784. Provide fitting clearances as required to meet the testing requirements of UL 1784 without the use of applied gasketing. Installation and clearances shall be in accordance with NFPA 80.
3.2 ADJUSTING AND CLEANING

A. Prime Coat Touchup: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08 11 13
SECTION 08 14 16 - FLUSH WOOD DOORS

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. Solid-core doors with wood-veneer faces.
   2. Factory finishing flush wood doors.

1.3 SUBMITTALS
A. Product Data: For each type of door indicated. Include details of core and edge construction, louver, and trim for openings. Include factory-finishing specifications.
B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
   1. Indicate doors to be factory finished and finish requirements.
   2. Indicate fire-protection ratings for fire-rated doors.
C. Samples for Verification: Factory finishes applied to actual door face materials, approximately 8 inches by 10 inches, for each material and finish.
D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE
A. Source Limitations: Obtain flush wood doors from single manufacturer.
B. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated" and "Architectural Flush Doors" for grade of door, core construction, and finish.
C. Forest Certification: Provide doors made with cores and veneers not less than 70% of wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

1.5 DELIVERY, STORAGE, AND HANDLING
A. Comply with requirements of referenced standard and manufacturer's written instructions.
B. Package doors individually in plastic bags or cardboard cartons.

1.6 PROJECT CONDITIONS
A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Algoma Hardwoods, Inc.
   2. Eggers Industries.
   3. Graham; an Assa Abloy Group company.
   5. Oshkosh Architectural Door Company.
   6. VT Industries Inc.

2.2 DOOR CONSTRUCTION, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards, WDMA I.S.1-A, "Architectural Wood Flush Doors."
   1. Provide AWI Quality Certification or WI Certified Compliance Labels indicating that doors comply with requirements of grades specified.

B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
   1. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
   2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

D. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

E. Mineral-Core Doors:
   1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
   2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
   3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

F. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:
   1. Grade: Premium, with Grade AA faces.
      a. Veneer Species: White Oak.
      b. Veneer Cut: Rift Cut.
      c. Match between Veneer Leaves: Book Match.
      d. Assembly of Veneer Leaves on Door Faces: Match existing.
   2. Core: Either glued wood stave or structural composite lumber.
   3. Construction: 5 or 7 plies. Stiles and rails are bonded to core, and then entire unit abrasive planed before veneering.
   4. WDMA I.S.1-A Performance Grade: Heavy Duty.
2.4 FABRICATION

A. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

B. Openings: Cut and trim openings through doors in factory.
1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished.

2.5 FACTORY FINISHING

A. Transparent Finish: Conversion varnish, premium grade system as prescribed by AWI.
1. Stain: To be selected from manufacturer’s standard finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.
1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
2. Install smoke- and draft-control doors according to NFPA 105.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
1. Clearances: Provide 1/8-inch at heads, jambs, and between pairs of doors. Provide 1/8-inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4-inch from bottom of door to top of threshold unless otherwise indicated.
   a. Comply with NFPA 80 for fire-rated doors.
2. Bevel fire-rated doors 1/8-inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16
SECTION 08 71 11 – DOOR HARDWARE (DESCRIPTIVE SPECIFICATION)

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes mechanical door hardware for the swinging doors.

B. Products furnished, but not installed, under this Section include the products listed below. Coordinating and scheduling the purchase and delivery of these products remain requirements of this Section.
   1. Permanent lock cores to be provided by Owner.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Action Submittals:
   1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
      a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
      b. Content: Include the following information:
         1) Identification number, location, hand, fire rating, size, and material of each door and frame.
         2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
         3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
         4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:
   1. For door hardware, an Architectural Hardware Consultant (AHC).

C. Source Limitations: Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.

D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

E. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
F. Accessibility Requirements: Comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design and ICC A117.1 for door hardware on doors in an accessible route.
   1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
   2. Comply with the following maximum opening-force requirements:
      a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
      b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
      c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
      d. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
      e. Closers: Adjust door and gate closer sweep periods so that, from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
      a. Exit Devices: Two years from date of Substantial Completion.
      b. Manual Closers: 10 years from date of Substantial Completion.
      c. Concealed Floor Closers: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.
   1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated.
   2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by descriptive titles corresponding to requirements specified in Part 2.

2.2 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Bommer Industries, Inc.
      b. Hager Companies.
      c. IVES; an Ingersoll-Rand brand.
      d. Lawrence Hardware Inc.
      e. McKinney Products Company; an ASSA ABLOY Group company.

B. Antifriction-Bearing Hinges:
      a. Bearing Material: Ball bearing.
      b. Grade: Grade 1 (heavy weight).
      c. Base and Pin Metal:
         1) Interior Hinges: Stainless steel with stainless-steel pin.
         2) Hinges for Fire-Rated Assemblies: Stainless steel with stainless-steel pin.
      a. Outsourcing Corridor Doors with Locks: Nonremovable.
   3. Tips: Flat button.
2.3 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
   2. Deadbolts: Minimum 1-inch bolt throw.

C. Lock Backset: 2-3/4 inches, unless otherwise indicated.

D. Lock Trim:
   1. Description: Corbin-Russwin.
   2. Levers: Wrought: LSM.
   3. Operating Device: Lever with escutcheons (roses).

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
   1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

F. Mortise Locks: BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; ML 2000 Series.

G. Thumbturn Cylinder with Occupancy Indicator:

2.4 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

B. Standard Lock Cylinders: BHMA A156.5; Grade 1; permanent cores that are interchangeable; face finished to match lockset.
   1. Number of Pins: Seven.
   2. Type: Mortise type.

C. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.5 KEYING

A. All final cores and keys shall be furnished by the Wayne State University Key Shop.

2.6 PUSH-PULLS

A. To be determined.

2.7 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.

B. Dustproof Strikes: Grade 1, polished wrought brass, with 3/4-inch diameter, spring-tension plunger.
2.8 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
   1. Manufacturers: LCN; an Ingersoll-Rand brand. No substitutions.

B. Surface Closer with Cover: Grade 1; Modern Type with mechanism enclosed in cover.
   1. Mounting: Parallel arm.
   2. Type: Hold open.
   3. Backcheck: Adjustable, effective between 60 and 85 degrees of door opening.
   5. Closing Power Adjustment: At least 50 percent more than minimum tested value.

2.9 MECHANICAL STOPS AND HOLDERS

A. Wall-Mounted Stops: BHMA A156.16; polished cast brass, bronze, or aluminum base metal.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hager Companies.
      b. Hiawatha, Inc.; a division of the Activar Construction Products Group.
      c. IVES; an Ingersoll-Rand brand.
      d. Rockwood Manufacturing Company; an ASSA ABLOY Group company.

B. Wall Bumpers: Grade 1; with rubber bumper; 2-1/2-inch diameter, minimum 3/4-inch projection from wall; with backplate for concealed fastener installation; with concave bumper configuration.

2.10 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8; type and grade as indicated in door hardware schedule.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Architectural Builders Hardware Mfg., Inc.
      b. Glynn-Johnson; An Ingersoll-Rand brand.
      c. Rockwood Manufacturing Company.
      d. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

2.11 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hager Companies.
      b. National Guard Products.
      c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.
      d. Reese Enterprises, Inc.
      e. Zero International, Inc.

B. Self-Adhesive Perimeter Gasketing: Silicone bulb gasket material held in place by self-adhesive; fastened to frame stop.

C. Door Sweeps: Neoprene gasket material held in place by flat aluminum housing or flange; mortised to bottom of door with screws.
2.12 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch-thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Baldwin Hardware Corporation.
      b. Burns Manufacturing Incorporated.
      c. Don-Jo Mfg., Inc.
      d. Hiawatha, Inc.; a division of the Activar Construction Products Group.
      e. InPro Corporation.
      f. IVES; an Ingersoll-Rand brand.
      g. Pawling Corporation.
      h. Rockwood Manufacturing Company.
      i. Trimco.

B. Kick Plates: 10 inches high by door width with allowance for frame stops.

2.13 CARD READERS AND KEYPADS

A. Keypad-enabled magnetic stripe card reader with aluminum alloy case and multi-format programmability:

2.14 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hager Companies.
      b. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
      c. Stanley Commercial Hardware; a division of Stanley Security Solutions.

B. Coat Hooks: Grade 1; two curved hooks with rounded ends; 3-inch projection from wall; for surface-screw application; fabricated from burnished cast aluminum.

2.15 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
   1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
   2. Fire-Rated Applications:
      a. Wood or Machine Screws: For the following:
         1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
         2) Strike plates to frames.
         3) Closers to doors and frames.
      b. Steel Through Bolts: For the following unless door blocking is provided:
         1) Surface hinges to doors.
         2) Closers to doors and frames.
         3) Surface-mounted exit devices.
   3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
   4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
   5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
2.16 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI WDHS.5 “Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors.”

C. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
   2. Custom Steel Doors and Frames: HMMA 831.

D. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

E. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

F. Lock Cylinders: Install construction cores to secure building and areas during construction period.
   1. Replace construction cores with permanent cores as directed by Owner.
   2. Furnish permanent cores to Owner for installation.

G. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

H. Coat Hook: Install on inside face of office doors.

I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

J. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

K. Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
### 3.2 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

### 3.3 DOOR HARDWARE SCHEDULE

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Doors normally held open by wall magnet. On fire alarm, power is cut and magnet is released. Coordinate with Electrical, Fire Alarm and all related trades.

### HARDWARE GROUP NO. 05

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### HARDWARE GROUP NO. 06

For use on mark/door #s: 204A 213B

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**HARDWARE GROUP NO. 07**

For use on mark/door #s: 208

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Operational Description: Coordinate system operation and component locations with the owner, the architect, and all related trades.

Unlocked: Door normally closed and unlocked via the access control system.

Locked: Door normally closed and locked. Presenting a valid credential to the reader will momentarily unlock the electric strike allowing access. Door to remain locked upon loss of power. Free egress at all times.

**HARDWARE GROUP NO. 08**

For use on mark/door #s: 210

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Operational Description: Coordinate system operation and component locations with the owner, the architect, and all related trades.

Unlocked: Door normally closed and unlocked via the access control system.

Locked: Door normally closed and locked. Presenting a valid credential to the reader will momentarily unlock the electric strike allowing access. Door to remain locked upon loss of power. Free egress at all times.
HARDWARE GROUP NO. 09

For use on mark/door #s: 204B 211A 213A

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Operational Description: Coordinate system operation and component locations with the owner, the architect, and all related trades.

Unlocked: Door normally closed and unlocked via the access control system.

Locked: Door normally closed and locked. Presenting a valid credential to the reader will momentarily unlock the electric strike allowing access. Door to remain locked upon loss of power or activation of the fire alarm (Fail-Secure). Free egress at all times.

END OF SECTION 08 71 11
SECTION 09 22 16 – NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes non-load-bearing steel framing systems for interior gypsum board assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Provide materials and construction identical to those tested according to ASTM E 119.

B. STC-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413.

2.2 FRAMING SYSTEMS

A. Steel Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners of equivalent minimum base-metal thickness.

1. Manufacturers: Subject to compliance with requirements, provide one of the following:
   1) Clark Dietrich Metal Framing.
   2) MBA Building Supplies.
   3) MRI Steel Framing, LLC.
   4) Steel Network Inc.
   5) Superior Metal Trim.
   6) Telling Industries.
   9. Depth: As indicated on Drawings.

B. Slip-Type Head Joints: Provide one of the following in thickness not less than indicated for studs and in width to accommodate depth of studs:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch-deep flanges, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.

2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges and fastened to studs, and outer runner sized to friction fit inside runner.

3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes due to deflection of structure above.

   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Clark Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
      2) MBA Building Supplies; Slotted Deflecto Track.
      3) Steel Network Inc. (The); VertiTrack VT Series.
      4) Superior Metal Trim; Superior Flex Track System (SFT).
      5) Telling Industries; Vertical Slip Track II.
C. Firestop Tracks: Manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Fire Trak Corp.; Fire Trak System.
      c. Metal-Lite, Inc.; The System.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   1. Manufacturers: Subject to compliance with requirements, provide one of the following:
      a. MRI Steel Framing, LLC.
   2. Minimum Base-Metal Thickness: As indicated on Drawings.

E. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.
   1. Manufacturers: Subject to compliance with requirements, provide one of the following:
      a. MRI Steel Framing, LLC.
   2. Depth: 1-1/2 inches.
   3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
   1. Manufacturers: Subject to compliance with requirements, provide one of the following:
      a. MRI Steel Framing, LLC.
   2. Minimum Base-Metal Thickness: 0.018 inch.

G. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
   1. Depth: 3/4 inch.
   2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
   3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

B. Hanger Attachments to Concrete:
   1. Anchors: Capable of sustaining a load equal to 5 times that imposed as determined by ASTM E 488.
      a. Type: Postinstalled, expansion anchor.
   2. Powder-Actuated Fasteners: Capable of sustaining, a load equal to 10 times that imposed as determined by ASTM E 1190.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch-wide flanges.
   1. Depth: 2-1/2 inches.

F. Furring Channels (Furring Members):
   1. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
   2. Steel Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners of equivalent minimum base-metal thickness.
   3. Minimum Base-Metal Thickness: TBD.
   4. Depth: TBD.
   1. Minimum Base-Metal Thickness: 0.018 inch.

2.4 AUXILIARY MATERIALS

A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide asphalt saturated organic felt or foam gasket.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.
   1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.2 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Install studs so flanges within framing system point in same direction.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
   2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
      a. Install two studs at each jamb unless otherwise indicated.
      b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
      c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
   3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
      a. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
         1) Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
      4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

D. Direct Furring: Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3.3 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
   3. Do not attach hangers to steel roof deck.
   4. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
   5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
   6. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16
SECTION 09 29 00 – GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes interior gypsum board.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency or as specified in accordance with UL in its "Fire Resistance Directory".

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Gypsum.
   2. CertainTeed Corporation.
   3. Georgia-Pacific Building Products.
   4. Lafarge North America Inc.
   6. PABCO Gypsum.
   8. USG Corporation.

B. Gypsum Wallboard: ASTM C 1396/C 1396M.
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

C. Gypsum Board, Type X: ASTM C 1396/C 1396M.
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.

B. Expansion Joint Covers:
   1. Size cover as required for width of joint.
   2. Provide fire rated cover as appropriate for wall type.
2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

2.5 AUXILIARY MATERIALS

A. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

B. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing).

C. Acoustical Joint Sealant: ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings as demonstrated by testing according to ASTM E 90.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
      b. Grabber Construction Products; Acoustical Sealant GSC.
      c. Pecora Corporation; AC-20 FTR.
      e. USG Corporation; SHEETROCK Acoustical Sealant.

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS

A. Comply with ASTM C 840.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. Install trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
   1. Aluminum Trim: Install in locations as indicated on Drawings.
   2. Control Joints: Install control joints at locations indicated on Drawings and according to ASTM C 840.

E. Install expansion joint cover of width required for existing joint. Install following manufacturers recommended procedures.

F. Prefill open joints, rounded or beveled edges, and damaged surface areas.

G. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

H. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
   1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

I. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
J. Remove and replace panels that are wet, moisture damaged, and/or mold damaged.

END OF SECTION 09 29 00
SECTION 09 30 00 - TILING

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. Porcelain floor tile and base.
   2. Ceramic wall tile.
   3. Crack isolation membrane.
   4. Metal edge strips.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.


1.4 PERFORMANCE REQUIREMENTS

A. Dynamic Coefficient of Friction (DCOF): For tile installed on walkway surfaces, provide products with the following DCOF AcuTest values in accordance with ANSI A137.1:
   1. Level Surfaces: Minimum 0.42.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification:
   1. Full-size units of each type and composition of tile and for each color and finish required.
   2. Metal edge strips in 3-inch lengths.

C. Qualification Data: For qualified Installer.

D. Product Certificates: For each type of product, signed by product manufacturer.

E. Material Test Reports: For each tile-setting and -grouting product, and special purpose tile.

F. Manufacturer’s System Warranty: Obtain 25 year system limited warranty from Laticrete; warranty is contingent on installation of the specified Laticrete products included in this Specification.

1.6 QUALITY ASSURANCE

A. Source Limitations for Tile Finish Systems: Obtain tile and all other materials for specific tile systems from one source
   1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
2. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

3. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
   a. Waterproof membrane.
   b. Crack isolation membrane.
   c. Joint sealants.
   d. Metal edge strips.

1.7 DELIVERY, STORAGE, AND HANDLING
A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
D. Store liquid materials in unopened containers and protected from freezing.
E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS
A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer’s written instructions.

1.9 EXTRA MATERIALS
A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 5% of amount installed for each type, composition, color, pattern, and size indicated; min. 3 sf of tile.
   2. Grout: Furnish quantity of grout equal to 5% of amount installed for each type, composition, and color indicated.

PART 2 - PRODUCTS
2.1 PRODUCTS, GENERAL
A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.
C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
   1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

D. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

A. Tile Types: As indicated on the Drawings.

2.3 WATERPROOF AND CRACK ISOLATION MEMBRANE

A. Waterproofing/crack isolation single component self curing liquid rubber polymer.
   1. Products: Subject to compliance with requirements in ANSI A118.10 and A118.12, provide the following:
      b. No substitutions.

2.4 SETTING MATERIALS

A. Thin Set Polymer Fortified Mortar: Comply with requirements in ANSI A118.4 and A118.11.
   1. For wall applications, provide mortar that complies with requirements for non-sagging mortar in ASNI 118.4.
   2. Manufacturers: Subject to compliance with requirements, provide the following:
      a. Custom Building Products Prolite Premium Large Format Tile Mortar.

B. Organic Adhesive: ANSI A136.1, Type I, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Custom Building Products Reliabond Professional Tile Adhesive.

2.5 GROUT MATERIALS

A. Epoxy-Based Stainproof Tile Grout: ANSI A118.3.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by the following:
      a. Custom Building Products CEG-Lite 100% Solids Commercial Epoxy Grout.

2.6 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements.
   1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.
C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Custom Building Products Commercial 100% Silicone Caulk.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
   1. Products: Subject to compliance with requirements, provide products by the following:
      a. Custom Building Products.

B. Metal Trim Profiles:
   1. Floors: As indicated on Drawings.
   2. Walls: As indicated on Drawings.

C. Temporary Protective Coating: Product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
   1. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

E. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.
   1. Products: Subject to compliance with requirements, provide products by the following:
      a. Custom Building Products.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
   1. Verify that substrates for setting tile are firm, dry, clean, and free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with adhesives, bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
   a. Verify that entire tile area surfaces that received a steel trowel finish have been mechanically scarified.
   b. Verify that protrusions, bumps, and ridges have been removed and that surfaces are smooth.
3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect. In locations where control joints are to be provided but are not specifically located, Contractor shall submit drawings proposed locations to Architect for review and approval. Architect shall have the option to adjust control joint locations and relocate or add control joints.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

C. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

A. Install tile according to TCNA F125A, full detail; with thin set bed.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Jointing Pattern: Lay out tile on grid pattern. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
   1. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
   2. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
   3. Floor tile layout to be preapproved by Architect.

E. Joint Widths: As indicated on Finish Legend.

F. Metal Trims Edge Strips: Install at locations indicated and where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile. Refer to Finish Legend.

H. Grout Sealer: Apply grout sealer according to grout-sealer manufacturer’s written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 WATERPROOF AND CRACK ISOLATION MEMBRANE INSTALLATION

A. Install full area substrate coverage waterproof and crack isolation membrane to comply with ANSI A118.10 and A118.12 and manufacturer’s written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over waterproof and crack isolation membrane until membrane has cured.

C. Waterproof and crack isolation membrane to be located at all floor tile areas.

D. Extend waterproof and crack isolation membrane a minimum of 6 inches up walls in wet areas.

3.5 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-Portland cement grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer’s written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed. Where more than seven days or more details traffic protection is recommended from tile manufacturer, follow manufacturer’s recommendations.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 09 30 00
SECTION 09 51 13 – ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY
   A. Section Includes: Acoustical panels and exposed suspension systems for ceilings.

1.2 PREINSTALLATION MEETINGS
   A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS
   A. Product test reports.
   B. Evaluation reports.
   C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS
   A. Maintenance data.

1.6 QUALITY ASSURANCE
   A. Testing Agency Qualifications: Qualified according to NVLAP.
   B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
      1. Build mockup of typical ceiling area as shown on Drawings.
      2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
   A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
      2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL PANEL CEILINGS, GENERAL
   A. Acoustical Panel Standard: Comply with ASTM E 1264.
B. Metal Suspension System Standard: Comply with ASTM C 635.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

2.3 ACOUSTICAL PANELS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Armstrong World Industries, Inc.
   2. CertainTeed Corp.
   3. Chicago Metallic Corporation.
   4. Tectum Inc.
   5. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Classification: Type IV, Form 2, Pattern E.

C. Color: White.

D. LR: 0.90.

E. NRC: 0.60, Type E-400 mounting according to ASTM E 795.

F. CAC: 40.

G. Edge/Joint Detail: Tegular reveal sized to fit flange of exposed suspension-system members.

H. Thickness: 3/4 inch.

I. Modular Size: As indicated on Drawings.

2.4 METAL SUSPENSION SYSTEM

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Armstrong World Industries, Inc.
   2. CertainTeed Corp.
   3. Chicago Metallic Corporation.
   4. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Standard-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation; with prefinished 15/16-inch-wide metal caps on flanges.
   2. End Condition of Cross Runners: Butt-edge type.
   3. Face Design: Flat, flush.

C. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.
   1. Arrange directionally patterned acoustical panels as indicated on reflected ceiling plans.

END OF SECTION 09 51 13
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. Resilient base.
   2. Resilient molding accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

1.4 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Furnish quantity of full-size units equal to 5% of amount installed for each type, color, and size indicated.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Roppe Corporation, USA.
   2. Johnsonite, Inc.
   3. Flexco.
   4. Burke Mercer Flooring Products, Division of Burke Industries Inc.

B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
   1. Style and Location:
      a. Style A, Straight: Provide in areas with carpet.
      b. Style B, Cove: Provide in areas with resilient flooring.

C. Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed or preformed.

G. Inside Corners: Job formed or preformed.

H. Colors: As indicated by manufacturer's designations. Refer to Drawings.
2.2 RUBBER MOLDING ACCESSORY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Roppe Corporation, USA.
   2. Johnsonite, Inc.
   3. Flexco.
   4. VPI, LLC, Floor Products Division.

B. Description: Rubber reducer strip for resilient flooring and transition strips.

C. Profile and Dimensions: As indicated.

D. Locations: Provide rubber molding accessories in areas indicated.

E. Colors and Patterns: As indicated by manufacturer’s designations.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer’s written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are the same temperature as the space where they are to be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.2 RESILIENT BASE INSTALLATION

A. Comply with manufacturer’s written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer’s recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.
H. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
   2. Form without producing discoloration (whitening) at bends.

I. Inside Corners:
   1. Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
   2. Miter or cope corners to minimize open joints.

3.3 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13
SECTION 09 65 19 – RESILIENT TILE FLOORING

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: Vinyl composition floor tile.

1.3 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Samples: Full-size units of each color and pattern of floor tile required.

1.4 CLOSEOUT SUBMITTALS
   A. Maintenance data.

1.5 EXTRA MATERIALS
   A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile Units: Furnish quantity of full-size units equal to 5% of amount installed for each type, color, and size indicated; min. 3 sf of tile.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
   A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 VINYL COMPOSITION FLOOR TILE
   A. Products: Subject to compliance with requirements, provide one of the following:
   1. Armstrong World Industries, Inc.
   2. AB; American Biltrite.
   3. Congoleum Corporation.
   4. Mannington Mills, Inc.
   B. Tile Standard: ASTM F 1066, Class 2, through-pattern.
   C. Wearing Surface: Smooth.
   D. Thickness: 0.125 inch.
   E. Size: 12 by 12 inches.
   F. Colors and Patterns: As indicated by manufacturer's designations. Refer to Drawings.
2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
   4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer’s written recommendations, but not less stringent than the following:
      a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
      b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.2 FLOOR TILE INSTALLATION

A. Comply with manufacturer’s written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
   1. Lay tiles square with room axis and in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
   1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern) and in pattern of colors and sizes indicated.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of
door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating
on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a
completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive
spreader marks, and other surface imperfections.

3.3 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor
polish.
   1. Apply three coats.

C. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19
SECTION 09 68 13 - TILE CARPETING

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 modular, tufted carpet tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show the following:
   1. Pattern type, location, and direction.
   2. Type, color, and location of insets and borders.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch long Samples.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.8 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
1.9 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
   3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE – Refer to Finish Legend

A. Products: Subject to compliance with requirements, provide the following:
   1. Refer to Finish Legend.

B. Color: Refer to Finish Legend.

C. Pattern: Refer to Finish Legend.

D. Installation Direction and Type: Refer to Finish Legend.

E. Primary Backing: Manufacturer’s standard backing.

F. Size: Refer to Finish Legend.

G. Performance Characteristics:
   1. Emissions: Provide carpet tile that complies with testing and product requirements of CRI’s “Green Label Plus” program.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
   1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Metal Edge/Transition Strips: Extruded aluminum with finish of profile and width shown on the Finish Legend, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8-inch wide or wider and protrusions more than 1/32-inch unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
   2. Remove yarns that protrude from carpet tile surface.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."
C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13
SECTION 09 91 00 - PAINTING

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 surface preparation and the application of paint systems on the following substrates:
   1. Exposed interior items and surfaces.
   2. Exposed exterior items and surfaces
   3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. All paints and coatings used on the interior of the building (defined as inside of the weatherproofing system and applied on-site), including sealants and adhesives used in mechanical, electrical, and plumbing work, shall comply with the following criteria:

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.
   1. Submit Samples on rigid backing, 8 inches square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.
   5. Submit VOC levels of each paint type.

1.4 QUALITY ASSURANCE

A. MPI Standards:
   1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
   1. Quantity: Furnish an additional 5 percent, but not less than 1 gallon of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Manufacturers: Subject to compliance with requirements, provide no-VOC products by The Sherwin-Williams Company or comparable products by one of the following:
   1. Benjamin Moore & Co.
   2. International Protective Coatings.
   3. O'Leary Paint Co.
   4. PPG Industries, Inc.
   5. Pratt & Lambert Paints.
   7. Tnemec.

C. Primer Sealers: Same manufacturer as top coats.

D. Block Fillers: Same manufacturer as top coats.

2.2 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
   1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. Supply each coating material in quantity required to complete entire project's work from a single production run.
   4. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. VOC Content for Interior Paints: For interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   1. Flat Paints and Coatings: 50 g/L.
   2. Nonflat Paints and Coatings: 150 g/L.
   3. Dry-Fog Coatings: 400 g/L.
   4. Primers, Sealers, and Undercoaters: 200 g/L.
   5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
   7. Pretreatment Wash Primers: 420 g/L.
   8. Floor Coatings: 100 g/L.
   9. Shellacs, Clear: 730 g/L.
   10. Shellacs, Pigmented: 550 g/L.

D. Colors: As selected by the Owner.
2.3 PAINT SYSTEMS - INTERIOR

A. Primers/Sealers:
   1. Interior Latex Primer/Sealer: MPI #50.

B. Latex Paints at Gypsum Board:
   1. Interior Latex (Flat): MPI #53 (Gloss Level 1).
   2. Interior Latex (Eggshell): MPI #52 (Gloss Level 3).
   3. Interior Latex (Semigloss): MPI #54 (Gloss Level 5).

2.4 ACRYLIC PAINTS AT STEEL

A. Steel Substrates:
   1. 1 Coat Pro Industrial Pro-Cryl Universal Water Based Primer.
   2. 2 Coats Pro Industrial Zero VOC Acrylic.

2.5 EPOXY COATINGS

A. Epoxy, Eggshell: Concrete/CMU vertical wall surfaces.
   1. Products: Subject to compliance with requirements, provide the following: Sherwin Williams Pro-Industrial Water Based Catalyzed Epoxy parts A and B (manufacturers standard color selection, to be selected by Architect).
   2. Prime Coat: Refer to Manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
   2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
D. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
   1. Mechanical Work:
      a. Uninsulated metal piping.
      b. Uninsulated plastic piping.
      c. Pipe hangers and supports.
      d. Tanks that do not have factory-applied final finishes.
      e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
      f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
      g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
   2. Electrical Work:
      a. Switchgear.
      b. Panelboards.
      c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

A. Gypsum Board: Provide the indicated "Professional" or "Industrial" coating systems over interior gypsum board and plaster surfaces:
   1. Low-Luster, Acrylic-Enamel Finish: Two finish coats over a primer.
      a. Primer: Latex-based, interior primer; total dry film thickness of not less than 1.2 mils.
b. Finish Coats: Low-luster (eggshell), acrylic-latex, interior enamel; total dry film thickness of not less than 2.6 mils.
   1) Super Spec Latex Eggshell Enamel 274.
   2) Color: As scheduled.

B. Ferrous Metal: Provide the indicated "Professional" or "Industrial" coating systems over factory-primed ferrous metal:
   1. Semigloss, Acrylic-Enamel Finish: Two finish coats over a factory-applied primer, or indicated primer as applicable.
      a. Primer (for factory-unprimed work): Waterborne, rust-inhibitive, acrylic primer; total dry film thickness of not less than 2.0 mils.
         1) SuperSpec HP Acrylic Metal Primer P04.
      b. Finish Coats: Semi-gloss, acrylic-latex, interior enamel; total dry film thickness of not less than 2.0 mils.
         1) Super Hide Latex Semi-Gloss Enamel 283.
         2) Color: As scheduled.

3.6 PIPE IDENTIFICATION COLOR SCHEDULE

A. Identify exposed pipes with the following colors.
   1. Colors are from the Tnemec Colorbook color card.
   2. Equivalent colors of other Manufacturers indicated in Part 2 of this Section may be used.

B. Where a facility has an existing identification system already in use, coordinate with the system in use.

C. In situations where 2 colors do not have sufficient contrast to easily differentiate between them, paint a 6-inch band of contrasting color at 30-inch intervals.

<table>
<thead>
<tr>
<th>Waste Water Plant Piping</th>
<th>Color Description</th>
<th>Tnemec Colorbook ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>Orange/Red with Black</td>
<td>International Orange 05SF with Black</td>
</tr>
<tr>
<td></td>
<td>Bands</td>
<td>Bands</td>
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<tr>
<td>Potable Water</td>
<td>Blue</td>
<td>Safety Blue SC06</td>
</tr>
<tr>
<td>Nonpotable Water</td>
<td>Blue with Black Bands</td>
<td>Safety Blue SC06 Black Bands</td>
</tr>
<tr>
<td>Heating Hot Water (Supply)</td>
<td>Blue</td>
<td>Safety Blue SC06</td>
</tr>
<tr>
<td>Heating Hot Water (Return)</td>
<td>Blue</td>
<td>Safety Blue SC06</td>
</tr>
<tr>
<td>Steam/Condensate</td>
<td>Orange</td>
<td>Safety Orange 04SF</td>
</tr>
<tr>
<td>Chilled Water Supply/Return</td>
<td>Blue</td>
<td>Safety Blue SC06</td>
</tr>
<tr>
<td>Condenser Water Supply/Return</td>
<td>Green</td>
<td>Safety Green 09SF</td>
</tr>
<tr>
<td>Fire Protection</td>
<td>Red</td>
<td>Safety Red 06SF</td>
</tr>
<tr>
<td>Sanitary/Sewage Lines</td>
<td>Dark Gray</td>
<td>Gray 33GR</td>
</tr>
<tr>
<td>Compressed Air</td>
<td>Green</td>
<td>Safety green 09SF</td>
</tr>
<tr>
<td>Drain Lines, Vent Lines</td>
<td>Gray</td>
<td>Slate Gray 31GR</td>
</tr>
<tr>
<td>Other Lines</td>
<td>Gray</td>
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</table>

END OF SECTION 09 91 00
SECTION 10.26.00 - WALL PROTECTION

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 corner guards.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.

B. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.

C. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

C. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
   1. Maintain room temperature within storage area at not less than 70 degrees F during the period plastic materials are stored.
   2. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 degrees F.
      a. Store corner-guard covers in a vertical position.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 degrees F for not less than 72 hours before beginning installation and for the remainder of the construction period.
1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Corner Guard: Full-size corner guards of maximum length equal to 2% of each type, color, and texture of units installed, but no fewer than two, 8-foot long units.

PART 2 - PRODUCTS

2.1 MATERIALS

A. PVC Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC with recycled content or acrylic-modified vinyl plastic with recycled content with integral color throughout; extruded and sheet material, thickness as indicated.
   1. Impact Resistance: Minimum 25.4 ft-lbf/in. of notch when tested according to ASTM D 256, Test Method A.
   2. Chemical and Stain Resistance: Tested according to ASTM D 543.
   3. Self-extinguishing when tested according to ASTM D 635.
   4. Smoke-Developed Index: 25 or less.
   5. Flame-Spread Index: 450 or less.
   6. 4000 Series recycled content.

2.2 CORNER GUARDS

A. Corner Guards - Refer to Finish Legend for style and color notes and locations.

B. Surface-Mounted, Full Height Plastic Corner Guards: Fabricated from PVC plastic; with formed edges; fabricated with 90- or 135-degree turn to match wall condition.
   1. Manufacturers: Refer to Finish Legend. 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. IPC Door and Wall Protection Systems; Division of InPro Corporation.
      b. Korogard Wall Protection Systems; a division of RJF International Corporation.
   2. Wing Size: Nominal 1-1/2-inch by 1-1/2-inch.
   3. Flexible Vinyl: 0.110-inch thickness.
   4. Mounting: Manufacturer’s heavy duty adhesive.
   5. Color and Texture: Refer to Finish Legend.

2.3 FABRICATION

A. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

B. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.

2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.

   a. Provide anchoring devices to withstand imposed loads.

3.4 CLEANING

A. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 26 00
SECTION 10 28 00 - TOILET AND BATH ACCESSORIES

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 washroom accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:
   1. Construction details and dimensions.
   2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Material and finish descriptions.
   4. Features that will be included for Project.
   5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated on Drawings.
   2. Identify products using designations indicated on Drawings.

1.4 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch minimum nominal thickness.

B. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

2.2 WASHROOM ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on products indicated on the Drawings. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
   1. Bobrick.
   2. American Specialties, Inc.
2.3 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 00
SECTION 21 05 00 – GENERAL FIRE SUPPRESSION PROVISIONS

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 specifying the general requirements for execution of that portion of the Work defined in Division 21 of these Specifications and as indicated on the Drawings:
   1. Major items include, but are not necessarily limited to:
      a. Cutting and patching.
      b. Concrete foundations and Support steel.
      c. Piping, fittings and valves.
      d. Fire protection systems.
      e. Demolition of existing work.
      f. Labor, materials, equipment, tools, supervision and start-up services.
      g. Instructions to Owner regarding operation.
      h. Incidental and related items necessary to a complete and functionally operational installation of the Work.

B. Division of Work: In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the Work to be performed by specific trades. The following are suggestions as to how the Work may be divided. This is not a complete list of all the Work:
   1. General Contractor:
      a. Install access doors.
      b. Refer to Division 01 Section “Cutting and Patching.”
      c. Provide access doors in walls and ceilings for access to fire suppression equipment.
   2. Fire Suppression Subcontractor:
      a. Furnish location, size and quantity of openings to Contractor before construction of new walls, ceilings, and floors.
      b. Furnish size and location of access doors required for this work as indicated on the Drawings to Contractor.
      c. Perform final cleaning of fire suppression systems and equipment.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of Division 21 shall comply with the following:
   2. ASME - American Society of Mechanical Engineers: B31.9 - Building Services Piping.
   4. International:
   5. NFPA Standards:
      a. 13 – Installation of Sprinkler Systems.
      b. 14 – Installation of Standpipe and Hose Systems.
      c. 24 – Installation of Private Fire Service Mains and their Appurtenances.
      d. 25 – Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
      e. 230 – Fire Protection of Storage.
   6. UL:
      b. 262 – Gate Valves for Fire Protection Service.
Wayne State University
Prentis Building Computer Lab Relocation
WSU Project Number 022-313456
FTCH Project Number 180746

General Fire Suppression Provisions
Section 21 05 00

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

A. System layout and design responsibility are included as Work of this Section:
   1. Details of construction, quantities, components and accessories indicated on the Drawings and in the specifications are minimum requirements.
   2. Minimum design criteria are as specified herein and as indicated on the Drawings.
   3. Confirm final design requirements with the authority or authorities having jurisdiction and the Owner’s insuring agency.
   4. Increases in system component requirements beyond these minimums that are determined by the system designer to be necessary to provide the functional intent and for a complete system shall not be a basis for increase in cost to Owner.

B. Construction details, components, accessories, sizes and model numbers indicated on the Drawings or in these specifications are used to indicate minimum levels of quality and coordination requirements.

C. Equipment supplied, whether as scheduled or selected from list of acceptable Manufacturers, must meet minimum requirements listed in specifications or on Drawings, be compatible with facility and intended use, and meet requirements for a functional system.

D. Drawings:
   1. Are diagrammatic and indicate general arrangement of systems and work included.
   2. Do not necessarily indicate every required valve, fitting, gage, elbow, transition, mounting support and access panel.
   3. Shall not be scaled for measurement or installation location.
   4. Shall not serve as Shop Drawings.

E. Schedules and model numbers shall not be used to:
   1. Serve as final, definitive quantity requirements. Contractor shall make own count as indicated on Drawings.
   2. Determine proper type or model with arrangement, mounting and accessories applicable.

F. Coordinate installation work of Division 21 with work of other trades to provide a complete and functional system. Generally, the location of ductwork, sanitary, storm and vent piping take precedence over fire protection and HVAC piping, electrical conduit and cable trays.

1.5 PRODUCT UNLOADING AND HANDLING

A. Unload equipment and materials required for completion of the Work.

B. Handle and store equipment and materials carefully to prevent damage. Method of rigging and handling shall be subject to the approval of an authorized representative of the equipment Manufacturer whose equipment is being handled.

c. 312 – Check Valves for Fire Protection Service.
d. 668 – Hose Valves for Fire Protection Service.
e. 753 – Alarm Accessories for Automatic Water-Supply Control Valves for Fire Protection Service.

1.6 MAINTENANCE

A. Special Tools: Where special tools are required for operation, furnish these to Owner.

B. Loose and Detachable Parts:
   1. Retain loose and small detachable parts of the apparatus and equipment furnished until the completion of the Work.
   2. Turn over these parts to Owner.

C. Construction Strainers:
   1. Remove after flushing and cleaning and prior to commencement of TAB.
   2. Attach removed construction strainer to piping where removed as proof of removal.

PART 2 - PRODUCTS

2.1 FABRICATIONS

A. Material installed in a ceiling plenum shall be either non-combustible or have a maximum flame spread of 25 and a maximum smoke developed rating of 50.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Character of Work: Installation shall be executed in a workmanlike manner and shall present a neat mechanical appearance when completed.

B. Laying Out of Work:
   1. Layout piping, equipment and components in accordance with the Contract Documents and the Manufacturer’s recommended practice, including provision of adequate space for maintenance. Review layout with Engineer prior to installation.
   2. Check drawings of other trades to verify spaces in which work will be installed. Maintain maximum head room and space conditions at all points. Where head room or space conditions appear inadequate, notify Engineer before proceeding with installation.
   3. If directed by Engineer, Contractor shall make reasonable modifications in the layout as required to permit proper execution of the Work and to prevent conflict with work of other trades.
   4. Work shall be installed so as to be ready for operation, maintenance and repair. Minor deviations from Drawings may be made to accomplish this. Changes shall not be made without approval of Engineer.

3.2 MODIFICATIONS TO EXISTING FACILITIES

A. Comply with the requirements of Division 02 Section “Selective Demolition” for removal of existing pipes, equipment, and other systems.

B. Comply with the requirements of Division 02 Section “Selective Demolition,” for all work related to the modification, alteration, conversion, renovation, and reuse of existing facilities.

3.3 PIPE FITTINGS

A. Provide insulating couplings or unions where dissimilar materials are joined.

B. Provide unions at valves and at equipment for making repairs.

3.4 PAINTING

A. Paint exposed, non-insulated piping in accordance with the requirements of Division 09 – Finishes.

C. Valves, Fittings, and Supports:
   1. Paint valves and fittings the same base color as the pipe they adjoin.
   2. Paint floor stands the same base color as the pipe they adjoin.
   3. Paint wall brackets and pipe hangers the same base color as the wall or ceiling they adjoin, or gray, if wall or ceiling is not painted.

3.5 CODING AND TAGGING

A. Piping:
   1. Applied to new piping after installation, insulation, and final painting.
   2. Conform to Owner's existing standards or conventions.
   3. Markings:
      a. Painted on, 1-inch high black letters.
      c. Directional arrow.
   4. Place markers at 20-foot centers with at least 1 in each room, and at each change in direction.
   5. Plastic coated "Set Mark-Snap-Around" pipe markers manufactured by Seton Name Plate Corp., New Haven, Connecticut; or approved equal, may be used in lieu of painted markers and bands.

B. Valves:
   1. Provide brass or minimum 1/16-inch thick laminated plastic tags indicating assigned valve number on valves.
   2. Furnish schedule(s) of tagged valves with number, location and purpose of each valve.
   3. Place a copy of each schedule:
      a. In the Maintenance Instructions.
      b. In a string tie envelope labeled "Valve Schedule" and mount on the wall in Mechanical Room.

C. Where valves are located above the ceilings, a cadmium plated screw shall be located in the ceiling tile directly below the device.

3.6 START-UP

A. Comply with the requirements of Division 01 Section “Starting and Adjusting.”

3.7 ADJUSTING

A. Adjust and align equipment for smooth operation:
   1. Plumb true and with parts in proper position and alignment.
   2. Rotating parts shall turn freely and in the correct direction.
   3. Flexible couplings shall be checked for alignment subject to Owner's approval.
   4. Follow Manufacturer's instructions.

B. The work of installation shall be executed in conformity with the best practice, so as to contribute to efficiency of operation, minimum noise or vibration, minimum maintenance, accessibility and sightlines.

3.8 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:
   1. Provide when required by individual Section.
   2. Provide the following services except where indicated otherwise in individual Sections:
      a. Inspect, check and approve system installation.
      b. Supervise system start-up.
      c. Provide written report indicating that system:
         1) Has been properly installed and lubricated.
         2) Is in accurate alignment.
3) Is free from undue stress imposed by connecting lines or anchor bolts.
4) Has been satisfactorily operated under full load conditions.
   d. Demonstrate operation of system to Owner’s personnel.
   e. Instruct Owner’s personnel on operation and maintenance of system.

B. Comply with the requirements of Division 01 Section “Starting and Adjusting.”

3.9 CLEANING AND FINISHING

A. Comply with the requirements of Division 01 Section “Cleaning and Waste Management.”

B. Entire installation shall be free from surface oil and grease before work will be considered for final payment.

C. After tests have been made and the system pronounced tight:
   1. Clean piping and equipment.

D. Final cleaning includes but is not limited to the following:
   1. Equipment with Factory Finishes:
      a. Wash factory-finished equipment with mild soap and water and leave in first-class condition, entirely free of stains or streaks.
      b. Do not use abrasive materials. Touch up scratches or other violations of the factory finish paint with matching paint from the equipment Manufacturer prior to cleaning.

END OF SECTION 21 05 00
SECTION 21 05 03 – STEEL PIPE AND FITTINGS FOR FIRE SUPPRESSION

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 furnishing and installation of steel pipe and fittings.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:

1. ANSI Standards:
   b. B16.4 - Cast-Iron Threaded Fittings, Class 125 and 250.
   c. B16.5 - Pipe Flanges and Flanged Fittings, Steel Nickel Alloys and Other Special Alloys.
   e. B16.11 - Forged Steel Fittings, Socket Welding and Threaded.
   f. B16.21 - Nonmetallic Flat Gasket for Pipe Flanges.
   g. B18.2.1 - Square and Hex Bolts and Screws, Inch Series.
   h. B18.2.2 - Square and Hex Nuts.
   i. B31.1 - Power Piping.
   j. B31.9 - Building Services Piping.

2. American Society of Mechanical Engineers (ASME) publications:

3. ASTM Standards:
   a. A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
   b. A105 - Forgings, Carbon Steel, for Piping Components.
   c. A106 - Seamless Carbon Steel Pipe for High-Temperature Service.
   e. A181 - Forgings, Carbon Steel for General Purpose Piping.
   f. A182 - Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings and Valves for High Temperature Service.
   g. A193 - Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
   h. A194 - Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
   i. A197 - Cupola Malleable Iron.
   j. A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
   k. A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile.

1.4 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

B. Labeling: Piping materials shall bear the label, stamp or other marking of all specified standards and testing compliance.
PART 2 - PRODUCTS

2.1 MATERIALS

A. General:
1. Except as herein specified or as indicated on the Drawings, all materials shall be in accordance with the Piping Systems Schedule in Part 3 of the appropriate applicable specification section.
2. Pipe 6'-0" and longer shall be permanently marked with the following information:
   a. Manufacturer's name.
   b. Pressure rating.
   c. Size.
3. All pipe joints shall be welded or grooved for pipe sizes 2-1/2 inches and larger.

B. Black Steel Pipe:
1. Black steel pipe shall be welded or seamless carbon steel, as specified for the type of service.
2. Welded black steel pipe shall meet the requirements of ASTM A53 or A106, and shall be Type F continuous-weld furnace butt-welding (CW), or Type E electric resistance welded (ERW) Grade B.
3. Seamless black steel pipe shall meet the requirements of ASTM A53 or A106, Type S seamless, Grade A or B.

2.2 FITTINGS

A. Unless specifically noted otherwise, all fittings shall be of the same material or finish material as the pipe in which they are used. Fittings shall be factory manufactured, no field fabricated fittings shall be allowed.

B. Unions:
1. Pipe Sizes 2 Inches and Smaller:
   a. Forged steel with ground joint.
   b. Properly fitted for design temperature and pressure.
   c. 2000 pound rated equal to Crane No. 250H or 251H.
2. Pipe Sizes 2-1/2 Inches and Greater: Use companion flanges where unions are required.

C. Tapped Bosses:
1. Permitted in pipes and fittings.
2. 1-1/2-inch maximum hole size.
3. Boss Construction:
   a. Weld material built up to a thickness 50% greater than required threads.
   b. Forged bosses as approved by Owner.
   c. 300 pound rated half couplings welded to pipe permitted for instrument connections 3/4-inch or smaller.

D. Screwed Fittings:
1. Class 300 iron in accordance with ANSI B16.4.
2. Nodular or ductile iron in accordance with ASTM A395.

E. Welding Fittings:
1. Meet ASTM A234 symbol WPA or WPB.
2. The A or B grade shall conform to the grade of pipe used with the fittings.
3. Dimensional standards shall conform to ANSI B16.9.

F. Flanges:
1. General:
   a. Welding neck or slip-on type with raised face.
   b. Conforming to ANSI B16.5.
   c. Class 150 and 300 conforming to ASTM A181, Grade I.
   d. Class 600 and 900 conforming to ASTM A105, Grade II.
2. Use threaded or socket weld type for piping smaller than 2-1/2 inches.
3. Use flat face steel flanges when matching cast iron companion flanges.
G. Flange Gaskets:
1. Nonasbestos compressed material conforming to ANSI B16.21 and suitable for 600 degrees F service.
2. Ring type, 1/16-inch thickness.
3. Spiral wound stainless steel for service over 300 psi.
4. Use full face gaskets with flat face flanges.

H. Bolting Material:
1. General:
   a. Carbon steel, square-head bolts and Grade 2H hex nuts.
   b. Bolt length shall be sufficient to extend completely through nut with maximum 3/8-inch projection.
   c. Dimensions conforming to ANSI B18.2 (bolts) and ASTM A194 (nuts).
2. Bolts:
   a. For service below 250 psig/450 degrees F, use Grade B conforming to ASTM A307.
   b. For service at or above 250 psig/450 degrees F, use Grade B7 conforming to ASTM A193.

I. Socket Welding Fittings: All forged steel socket-welding fittings shall conform to ANSI Standard B16.11 ASTM A105 Gr. II, equal to Crane 3,000-pound forged fittings.

2.3 GROOVED COUPLING SYSTEMS

A. Manufacturers:
1. Victaulic.
2. Or approved equal.

B. General:
1. All grooved piping materials shall conform with the specifications governing the systems or application for which they are used.
2. All couplings and fittings shall be finished with hot-dip galvanizing or alkyd enamel paint, unless copper.

C. Pipe and Tubing:
1. Standard Weight Steel Pipe:
   a. Comply with the requirements of this Section.
   b. ASTM Schedule 40, A53 black steel or hot-dipped zinc-coated.

D. Couplings:
1. Housing:
2. Style:
   a. Standard Weight Steel Pipe:
      1) Rigid style.
      2) Victaulic “Zero-Flex” style 07
3. Gasket:
   a. Water Service: EDPM.
   b. Oil, Air Vacuum Service: Nitrile.
4. Bolts – Nuts:
   a. Track bolts with 110,000 psi tensile strength.
   b. Heavy hex nuts.
   c. Zinc electroplated carbon steel.

E. Fittings:
1. Steel, ductile iron.
2. Grooves or shoulders compatible with system couplings.
3. Segmentally welded fittings not acceptable.
4. Clamp-on mechanical not acceptable.

F. Valves:
1. Refer to Division 21 Section “Water Based Fire Suppression Systems” or specification section governing the system or application for which they are used.
2. Compatible with grooved pipe coupling.
G. Strainers:
   1. Refer to Division 21 Section “Water Based Fire Suppression Systems.”
   2. Compatible with grooved pipe coupling.

PART 3 - EXECUTION

3.1 PREPARATION

   A. During Freezing Weather:
      1. Protect all materials in such a manner that no harm can be done to:
         a. Installations already made.
         b. Materials and equipment on the Site.
      2. Furnish all necessary protection for such installations and equipment as may be required.

3.2 ERECTION

   A. General:
      1. All Piping: Follow approved paths as indicated on the Drawings.
      2. Connect to existing lines where required, or to equipment in an approved manner.
      3. Locate Pipes, Valves and Equipment to Provide:
         b. Minimum obstruction of passageways and working space.
      4. Normally, all pipe runs shall be plumb, parallel with the building and level, except for drain slope.
      5. Be responsible for establishing and maintaining drain slope of piping in order to ensure drainage.
      6. Expansion of Piping:
         a. All pipe connections shall provide freedom of movement of the piping during expansion and
            contraction without springing of piping or injury to building steel or structure.
         b. Any damage to building steel or structure as a result of work installed by Contractor shall be
            repaired at Contractor's expense.
      7. As Piping Material is Erected:
         a. Thoroughly clean the inside of all piping.
         b. Remove foreign material such as scale, sand, weld spatter, particles and cutting chips.
      8. Provide caps or plugs in all openings at the end of each day's work and as otherwise directed for the
         protection of the piping. Particular attention must be given to avoid the possibility of any foreign material
         entering the pipes.
      9. Flanges shall be made on pipe so that the gasket surface forms an angle of 90 degrees with the pipe
         axis. Screwed flanges shall be made on until the pipe projects through the flanges and then the flanges
         must be refaced.

   B. Sleeves and Holes:
      1. Contractor shall be responsible for cutting required holes and openings in floors, walls and other
         structures, except as noted on the Drawings. Sleeves will be placed by Contractor in all such openings,
         and no holes shall be cut without Owner's approval. Sleeves shall be in accordance with the standard
         details included in the Drawings.
      2. All holes in floors, walls, roofs, etc., where pipe lines or other materials have been removed or installed,
         shall be neatly and properly filled with concrete, brick or other material in accordance with the general
         character of the construction at the location.

   C. Unions and Eccentric Fittings:
      1. Unions shall be provided at each screwed valve and where their use will facilitate dismantling of the
         piping and as required or directed in special cases.
      2. Eccentric fittings or eccentric reducing couplings shall be provided in all cases where air or water pockets
         would otherwise occur in the main due to the reduction in pipe size.

   D. Pipe Joints:
      1. Pipe connections at all valves shall be mechanically joined unless otherwise indicated on the Drawings
         or reviewed by Owner or Engineer.
      2. Pipe joints which will be buried or otherwise concealed shall be welded regardless of size.
      3. Mitered joints shall not be permitted.
4. In general, black steel 2-1/2-inch and larger shall be welded except that a flange or union shall be provided at all valves and at equipment.

5. The connections to welded 2-1/2-inch and larger pipe shall be made with a welding tee or Weld-o-let of butt, socket or threaded type as required. Scarf welding of side connections shall not be permitted.

6. Only welding ells shall be used for changing pipe directions of welded pipe lines.

E. Pipe Welding:
1. Where welding is called for, it shall be of the fusion process and shall consist of welding by means of either the oxyacetylene or electric arc process.

2. All welding shall conform to the ASME Boiler and Pressure Vessel Code or the ANSI Code for Pressure Piping. All welders shall be qualified in accordance with ASME Standard Qualifications for Welding Procedures, Welders and Welding Operators, or Section 9 of the ASME Boiler and Pressure Vessel Code for the class of piping being welded. Submit welding qualifications for all welders on the Project when requested by Engineer.

3. Each welded joint shall have the welder's initials, last 2 numbers of the year and a symbol indicating whether backing rings were used or not. All marks shall be located where easily accessible according to the following order or preference: Top center, north, east, south and west.

3.3 GROOVED SYSTEMS

A. Piping shall be prepared in accordance with the latest Manufacturer's specifications or other standards applicable.

B. Standard weight (Schedule 40 or heavier) steel piping may be roll grooved or cut grooved.

C. Couplings, fittings, valves and pipe shall be assembled in accordance with latest Manufacturer's instructions.

D. Cutting, Grooving and Crimping:
1. All flexible pipe fittings including grooved, cut and plain end and all quick fittings shall be installed with a machine specifically designed for this purpose.

2. All piping to be grooved, cut and crimped shall be prepared using this specifically designed machine.

E. Mechanical joints are not allowed within walls.

F. Manufacturer’s Field Service: Arrange and pay for Manufacturer’s engineer to provide the installation direction for a minimum onsite time of 1 day.

G. Submit written approval of installation.

END OF SECTION 21 05 03
SECTION 21 05 29 – HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

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 furnishing and installation of all pipe hanging and support systems.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:

1. MSS - Manufacturers Standardization Society:
   b. SP-69 - Pipe Hangers and Supports - Selection and Application - 1996.
   c. SP-90 - Guidelines on Terminology for Pipe Hangers and Supports.

2. Hanger and supports for fire suppression systems shall also conform to the following standards published by the National Fire Protection Association in the National Fire Codes for fixed extinguishing equipment:
   b. NFPA-14 - Standpipe and Hose Systems.

3. Hangers in general are covered in NFPA-13. If the system is other than a standard water sprinkler system, the applicable NFPA Standard shall also be consulted.

1.4 DEFINITIONS

A. Pipe Restraint: Pipe supporting element which is designed to limit or direct pipe movement due to internal static pressure, gravitational forces, frictional forces from hangers, rollers, and guides, and forces from expansion compensation devices:
   1. Pipe restraints are not designed to restrain pipe movement caused by thermal expansion, shock or surge.

B. Pipe Guide: A pipe restraint designed to direct pipe movement along a single axis.

C. Pipe Anchor: A pipe restraint designed to provide a static point about which pipe movement normally occurs, by limiting the longitudinal and axial movement at that point.

D. Other Terms: As defined in MSS SP-90.

1.5 DESIGN AND PERFORMANCE REQUIREMENTS

A. Unless otherwise indicated on Drawings or in these Specifications, this Contractor shall be responsible to design and provide all pipe hangers, supports, restraints, braces, framing, etc., as required to comply with all applicable building codes, ASME B31 and MSS SP-69.

B. Comply with the requirements of Division 21 Section “Sound and Vibration Control for Fire Suppression” for vibration isolation of piping.

C. Comply with the requirements of Division 21 Section “Water Based Fire Suppression Systems” for pipe hangers and supports for water based fire protection piping.
1.6 SUBMITTALS

A. Manufacturer's Literature: For structural steel attachment devices, hangers and rollers. Include name of Manufacturer; model number and MSS Type, if applicable; and piping systems to be used with.

B. Submit Shop Drawings for all engineered hanger, restraints and support assemblies.

C. Upon request by Engineer, submit calculations for all engineered hanger, restraints and support assemblies.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The materials of all pipe hanging and supporting elements shall be in accordance with the latest requirements of the ASME Code for Pressure Piping B31.1 and MSS Standard Practice MSS SP-58 and MSS SP-69 except as supplemented or modified by the requirements of these Specifications.

B. The material in contact with the pipe shall be compatible with the piping material so that neither shall have a deteriorating action on the other.

C. Special Finishes and Materials:
   1. All ferrous hangers and supports used in the following areas shall be hot dip galvanized unless noted otherwise:
      a. In wet or potentially wet areas.

2.2 MANUFACTURERS

A. Elcon.

B. Michigan Hanger.

C. Anvil.

D. Bergen.

E. Hilti.

F. Lindapter.

2.3 PIPE HANGERS AND SUPPORTS

A. Horizontal Piping Hangers: Unless otherwise indicated and except as specified in piping system Specification sections, install the following types:
   1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).
   2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN15 to DN600), if little or no insulation is required.
   3. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN15 to DN100), to allow off-center closure for hanger installation before pipe erection.
   4. Adjustable Swivel Split or Solid Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN20 to DN200).
   5. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN200).
   6. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).
   7. Adjustable Swivel Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN15 to DN50).
Hangers and Supports for Fire Suppression

B. Supports and Rollers:
1. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast iron floor flange.
2. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast iron floor flange with U-bolt to retain pipe.
3. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion type support for pipes, NPS 2-1/2 to NPS 36 (DN65 to DN900), if vertical adjustment is required, with steel pipe base stanchion support and cast iron floor flange.
4. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN25 to DN750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.
5. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN65 to DN500), from single rod if horizontal movement caused by expansion and contraction might occur.
6. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN50 to DN1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
7. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN50 to DN600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
8. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN50 to DN750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

C. Vertical Piping Clamps: Unless otherwise indicated and except as specified in piping system specification 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 (DN20 to DN500).
2. Carbon or Alloy Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500), if longer ends are required for riser clamps.

D. Hanger Rod Attachments: Unless otherwise indicated and except as specified in piping system specification sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 degree F (49 to 232 degree C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type II, 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 degree F (49 to 232 degree C) piping installations.

E. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification sections, install the following types:
1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
2. Spring Cushion Roll Hangers (MSS Type 49): For equipping Type 42 roll hanger with springs.
3. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
4. Variable Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25% to absorb expansion and contraction of piping system from hanger.
5. Variable Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25% to absorb expansion and contraction of piping system from base support.
6. Variable Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25% to absorb expansion and contraction of piping system from trapeze support.
7. 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 1 trapeze member.

2.4 HANGER RODS

   A. Minimum rod diameters for rigid rod hangers shall be as shown in MSS SP-69 Table 4 (Minimum Rod Diameter for Single Rigid Rod Hangers) and as indicated in Part 3 of these Specifications.

   B. Hanger rods shall be subject to tensile loading only. At hanger locations where lateral or axial movement is anticipated, suitable linkage shall be provided to permit swing.

   C. Rod material must be compatible with hanger and comply with above. Do not field cut thread on galvanized rod.

   D. Do not use perforated strap.

   E. Multiple Supports:
      1. Horizontal banks of pipe may be supported on a common base member without regard to the pipe centerline elevation.
      2. In the supporting of multiple pipe runs, provisions shall be made to keep the lines in their relative lateral positions, using clamps or clips as required. Lines subject to thermal expansion shall be free to roll axially or slide.

2.5 SADDLES AND SHIELDS

   A. All Piping:
      1. Saddle: MSS Type 39 (Grinnell #160-164), or Anvil Figure 162 or 165.
      2. Shield: MSS Type 40 (Grinnell #167), provide and install in accordance with Manufacturer's shield size selection tables.
      3. The contour of the saddle shall match the radius of the pipe insulation.

2.6 FABRICATED STEEL SUPPORTS AND RESTRAINTS

   A. Provide as required:
      1. Steel shapes and plates.
      2. Bolts.
      3. Welds.

   B. Materials and fabrication in accordance with:
      2. AISC Code of Standard Practice for Steel Buildings and Bridges (except Section 4.2.1.).

   C. Design: Responsibility of Subcontractor.

   D. Paint all finished fabrications:
      1. As specified in Division 09 Section "Painting."
      2. Color as directed by Owner.

2.7 BUILDING ATTACHMENTS

   A. As indicated on the Drawings or in the Specifications.
B. Concrete Attachments:
   1. Provide galvanized finish for all attachments used in wet or potentially wet areas.
   2. Provide stainless steel bolts and nuts in wet and potentially wet areas.
   3. Poured Concrete:
      a. Use cast-in-place inserts or bolted surface mounted attachments, at Contractor’s option.
      b. Expansion style anchors are not permitted on piping systems subject to vibration.
   4. Precast Concrete Tees:
      a. Use fittings specifically designed for attachment to stems of precast tees.
      b. Drilling is not permitted except where specifically approved by Engineer and coordinated with precast Manufacturer to miss embedded, prestressed steel strands.
   5. Precast Concrete Plank:
      a. Use toggle bolt attachment as indicated on Drawings.
      b. Alternatively, provide adhesive anchor, Hilti HY-20; or as approved.
      c. Drilling is not permitted except where specifically approved by Engineer and coordinated with precast Manufacturer to miss embedded, prestressed steel strands.

C. Horizontal Piping:
   1. Steel W, I, or S shapes: MSS Type 23 clamp with retaining clip, (Grinnell Fig. 87) up to 2-inch; MSS Type 28 (Grinnell Fig. 292) or MSS Type 21 (Grinnell Fig. 133, 134) above 2-inch.
   2. Steel Channel: MSS Type 20 universal channel clamp.
   3. Bar Joists: Steel washer plate (Grinnell Fig. 60).
   4. Concrete: See "B" above.
   5. Timber: Angle bracket and lag screws or as detailed on Drawings.
   6. Steel Z Shapes: Custom attachment required.

D. Vertical Piping:
   1. Steel Shapes: Welded brackets as approved by Engineer.
   2. Concrete: See "B" above.
   3. Timber: Ceiling hanger flange (Grinnell Fig. 128R, 153) angle brackets and lag screws, or as detailed on Drawings.

E. In the absence of a Specification for a particular type of attachment, furnish attachments comparable in type and quality to that specified above for a similar situation.

2.8 METAL FRAMING PIPE SUPPORT SYSTEMS

A. Acceptable Manufacturers:
   1. Bee Line.
   2. Elcen.
   3. Super Strut, Inc.

B. Provide products from 1 Manufacturer.

C. Channel (Standard Applications):
   1. Mild strip steel.
   2. 12 gage minimum material.
   3. Factory painted equal to Unistrut Perma-Green.
   4. Equal to Unistrut Part No. P1000.

D. Clamps and Supports:
   1. Beam clamp equal to Unistrut Part No. P2785.
   2. Pipe strap equal to Unistrut Part No. P2558.
   3. Pipe roller equal to Unistrut Part No. P2474.
   4. All items fabricated in material equal to channel specifications.
E. Clamp Nuts:
1. Electro-galvanized stainless steel for use with stainless steel and fiberglass parts.
2. Mild bar steel for standard applications.
4. Equal to Unistrut Part No. P1012.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. General Requirements:
1. The selection of pipe hangers and supports shall be based on the overall design concept of the piping system and any special requirements which may be called for in these Specifications or as indicated on the Drawings. The support systems shall provide for, and control, the free or intended movement of the piping including its movement in relation to that of the connected equipment. They shall prevent excess stress resulting from the transfer of weight being introduced into the pipe or connected equipment.
2. The selection of hangers and supports shall be made to provide the piping system with the degree of control that its operating characteristics require.
3. The selection of hangers or supports will take into consideration the combined weight of the supported systems, including system contents and test water.
4. The spans in MSS SP-69 Table 3 do not apply where concentrated weights, such as valves or heavy fittings, or where changes in direction of the piping occur between hangers.
5. Select all hangers and supports rated for the maximum potential loading with pipe full.
6. Select hangers for cold (less than 50 degrees F) piping service for installation over the insulation.
7. Where significant, vertical movement of pipe occurs at the hanger location a resilient support must be used:
   a. Selection of resilient supports shall be based on permissible load variations and effects on adjacent equipment. Support selection for typical load variations are shown on MSS SP-69 Table 2 (Spring Support Selection). Load and movement calculations shall be made for the proper selection of spring hangers.
   b. Vertical movement and load transfer from riser expansion to horizontal runs shall be given consideration when applying spring hangers.
   c. Spring cushion hangers may be used where vertical movement does not exceed 1/4-inch and where formal load and movement calculations are not required.
   d. Variable spring hangers shall be used for all other resilient support requirements except as noted in the following paragraph.
   e. Constant support hangers shall be used on piping systems where the deviation in supporting force must be limited to 6% and which cannot be accommodated by a variable spring hanger.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification sections.

3.2 HANGER AND SUPPORT INSTALLATION

A. Pipe Hanger and Support 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.

B. General:
1. Adjust all components as required for proper operation and required pipe slope.
2. Double nut all support rods at hangers.
3. Location and Routing:
   a. Install Piping as Indicated:
      1) On the Drawings.
      2) On the reviewed Shop Drawings.
   b. Secure Engineer's approval for all pipe routing changes.
4. Coordinate with other trades for placement of concrete attachments prior to concrete pouring.
5. Install all items in accordance with Manufacturer's instructions.

C. Support at Valves: Provide additional supports at all valves in piping 4-inch and larger.
D. Vertical Risers:
1. Support independently from adjacent hangers on horizontal piping.
2. Vertical Threaded, Welded or Grooved Steel Piping:
   a. Support at the base of the riser and at every other floor.
   b. Maximum allowable unsupported piping length is 12 feet.

E. Horizontal Runs:
1. General:
   a. Provide adequate supports for the loads with a factor of safety of at least 5 (400 pounds minimum).
   b. Provide protective shield at all hangers and rollers supporting plastic pipe and coated pipe.
   c. Support spacing not to exceed MSS SP-69 Table 3, or the requirements for seismic restraint, whichever is more stringent.
   d. Hanger rod diameter shall not be less than the requirements of MSS SP-69 Table 4, or the requirements for seismic restraint, whichever is more stringent.
2. Rollers: All piping systems designed to accommodate thermal expansion movement shall be mounted on rollers.
3. Bar Joists: Attachments to bar joists shall be made to top member and at panel points.

3.3 PIPE RESTRAINTS
A. Provide adequate pipe restraints for all expansion or contraction of piping due to temperature change:
1. Including, but not limited to, that indicated on the Drawings.
2. As instructed by Owner or Engineer.
3. At locations to prevent stresses from exceeding those permitted by ANSI B31 and to prevent transfer of loading and stresses to connected equipment.
4. Spacing: Unless otherwise indicated, install at ends of main pipe runs, at intermediate joints in pipe runs between expansion loops and bends.

3.4 PAINTING
A. Touchup: Cleaning and touchup of painting of field welds, bolted connections and abraded areas of shop paint on miscellaneous metal are specified in Division 09 Section “Painting.”

B. Galvanized Surfaces: Clean welds, bolted connections and abraded areas. Apply galvanizing repair paint to comply with ASTM A780.

END OF SECTION 21 05 29
SECTION 21 05 31 – PENETRATIONS FOR FIRE SUPPRESSION

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 furnishing and installation of the major items listed below:
1. Pipe sleeves.
2. Flashing and sealing of all mechanical openings through weather or waterproofed walls, roofs and floors.
3. Sealing and finishing of all mechanical openings.
4. Provide UL rated firestopping and sealing at all new and existing pipe penetrations of fire rated walls.

B. Division of Work: In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the work to be performed by specific trades. The following are suggestions as to how the Work may be divided. This is not a complete list of all the work:
1. General Contractor:
   a. Locate and place all sleeved and framed openings as part of constructing the wall and floor surfaces in which the openings occur.
   b. Provide all lintels and required stiffening members for wall and floor openings.
   c. Cut roofing and install flashing for all required openings in proprietary roof membrane systems.
   d. Cut all roof deck openings and provide required framing supports.

2. Fire Suppression Subcontractor:
   a. Advise General Contractor of quantity, location and size of all required openings.
   b. Provide all curbs, sleeves, seals, escutcheons and related materials required for finishing, sealing and waterproofing mechanical openings. Furnish all flashing and counterflashing.
   c. Arrange and pay for all openings required after wall, roof and floor construction is complete.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the Work of this Section shall comply with ASTM D2202 - Test Method for Slump of Sealants.

1.4 SUBMITTALS

A. Manufacturer's Literature: For all premanufactured curbs and sealing assemblies.
   1. Manufacturer's name.
   2. Model number.
   3. Details of construction and installation.
   4. Certified load-bearing data for all curbs.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed submittals.

B. Openings in Fire-Rated Surfaces: As specified in Division 07 Section “Penetration Firestopping.”
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Modular Mechanical Seals:
   1. Thunderline/Link-Seal.
   2. As approved.

B. Backer Rod:  Industrial Thermo Polymers, “Standard Backer Rod”.

C. Acoustical Sealant:  Pecora, “BA-98”.

D. Non-Expanding Sealant:  General Electric SilPruf SCS2000:
   1. VOC content must be 2250 g/liter or less.

2.2 MATERIALS

A. Backer Rod:
   1. Extruded round, closed cell, polyethylene foam.
   2. Resilient, non-exuding.
   3. Density:  2.0 pounds per cubic foot.
   4. Tensile Strength:  50 psi.
   5. Nonabsorbent to water and gasoline.
   6. Suitable for use as a backing for acoustical sealant.
   7. Compatible with sealant and approved by sealant Manufacturer.

B. Acoustical Sealant:
   1. Nonfire-Rated Penetrations:
      a. Non-drying, non-hardening and non-bleeding.
      b. Laboratory tested sealant which effectively reduces airborne sound transmission through wall systems.
      c. Viscosity:  350,000 to 400,000 (Brookfield No. 65, 10 RPM).
      d. Aging:  Firm but rubbery, good tack after 50 days conditioned at 160 degrees F.
      e. Slump:  0.1 to 0.2 inches in accordance with ASTM D2202.
      f. Color:  Gray.
   2. Fire-Rated Penetrations:  Permanently flexible, approved firestop putty.  Refer to Division 07 Section “Penetration Firestopping.”

C. Packing Material for Penetrations:
   1. Glass Fiber or Mineral Fiber:
      a. Noncombustible.
      b. Resistant to water, mildew, and vermin.
   2. Expanding Resilient Foams:
      a. Acceptable alternative if manufactured for this purpose.
      b. Minimum material density:  60 pounds per cubic foot.

2.3 SLEEVES

A. Materials:
   1. 18-Gage Galvanized Steel:  For pipe penetrations in non-bearing walls.
   2. Schedule 40 Steel Pipe:
      a. For all bearing walls.
      b. For all floors.
B. Size All Sleeves:
   1. To allow for movement due to expansion.
   2. To provide for continuous insulation, except as required by Division 07 Section “Penetration Firestopping.”
   3. As indicated on the Drawings.

2.4 MANUFACTURED UNITS

A. Modular Mechanical Seals:
   1. Provide modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening.
   2. The elastomeric element shall be sized and selected in accordance with Manufacturer's recommendations and have the following properties as designated by ASTM:
      a. For Standard Service Applications:
         1) -40 to +250 degrees F (-40 to +121 degrees C).
         2) EPDM = ASTM D2000 M3 BA510.

PART 3 - EXECUTION

3.1 INTERIOR WALL AND FLOOR OPENINGS

A. Use riser sleeve with integral flashing flange and clamp for all waterproof membrane floors.

B. Seal airtight all openings around pipes in the structure at:
   1. Mechanical equipment rooms.
   2. Slab and noise sensitive wall penetrations.
   3. Penetrations of all drywall ceilings.
   4. All enclosed shaft penetrations.

C. Pipe Penetrations:
   1. Where a pipe passes through a wall, ceiling, or floor slab, cast or grout a steel sleeve into the structure.
   2. Internal diameter of the sleeve: 2 inches (50 mm) larger than the external diameter of the pipe passing through it.
   3. After all of the piping is installed in a specific area, check the clearance and correct it, if necessary, to within 1/2-inch (12 mm).
   4. Pack the void full depth with packing material and seal at both ends, 1-inch (25 mm) deep.
   5. Where pipes pass through a masonry wall in sufficient numbers and density that individual pack-and-caulk details are not possible, a special isolation detail shall be developed:
      a. Cast pipe sleeves in a block of concrete with the sleeves located a minimum of 2 inches (50 mm) apart.
      b. Block thickness: At least as thick as the surrounding wall construction.
      c. Each sleeve diameter: 2 inches (50 mm) larger than the external diameter of the pipe passing through it.
      d. Build the sleeved block into the wall.
      e. After the pipes are installed, pack and caulk voids as indicated above.
   6. Fire Protection Pipes:
      a. May be sleeved and sealed as indicated above, or (except where crossing an acoustic joint) may be grouted and caulked into the structure as follows:
         1) Before grout has set, rake a 1/2-inch deep (12 mm by 12 mm) groove around the pipe on each side of the wall or slab.
         2) After the grout has set, fill groove full depth with sealant.
      b. Penetration of sound isolating ceilings (concrete or multi-layer drywall) by fire protection pipes and heads shall be sleeved and sealed as indicated herein. There shall be no rigid connection between ceiling and pipes or heads.

3.2 ESCUTCHEONS AND CLOSURE COLLARS

A. Includes ceilings, partitions, floor, and walls.
B. Provide Escutcheons for All Piping:
   1. Sized to fit over coverings.
   2. In All Dry Finished Areas: Chrome plated.

END OF SECTION 21 05 31
SECTION 21 10 00 – WATER BASED FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the design, furnishing, and installation of a fire protection system:
1. Wet pipe system with sprinklers.
2. Riser system and stand pipe system.
4. Controls.
5. Inspector's test station(s).
6. Post indicator valve.

B. Division of Work: In accordance with the General Conditions, Contractor is responsible for dividing Work among the Subcontractors and Suppliers and for delineating the work to be performed by specific trades. The following are suggestions as to how Work may be divided. This is not a complete list of all Work:
1. Fire Protection Subcontractor:
   a. Prepare system design and layout.
   b. Furnish and install all system piping and components including, but not necessarily limited to, flow switches, valve supervisory switches, and air pressure switches.
   c. Secure approvals from agencies having jurisdiction.
   d. Ensure that final installation, as constructed, complies with fire protection requirements and does not subject any part of this system to unnecessary risk of freezing or other damage.
2. Electrical Subcontractor: Provide all necessary wiring interface and wire to building fire alarm system including, but not necessarily limited to, wiring of alarm bells, flow switches, valve supervisory switches, and air pressure switches.
3. General Contractor:
   a. Provide access to all valves, sprinkler heads and devices.
   b. Provide louvers, heat trace or other means to protect all wet parts of the system from freezing.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
1. ANSI/ASME Standards:
   a. B16.3 - Malleable-Iron Threaded Fittings, Classes 150 and 300.
   d. B36.10M - Welded and Seamless Wrought Steel Pipe.
2. ANSI/AWWA Standard:
   b. C110/A21.10 - Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids.
   e. C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
3. ASTM Specification:
   a. A53 - Specifications for Welded and Seamless Steel Pipe.
   d. A197 - Cupola Malleable Iron.
   e. A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
f. B75 - Specification for Seamless Copper Tube.
g. B88 - Specifications for Seamless Copper Tube.
h. B251 - Specifications for General Requirements for Wrought Seamless Copper and Copper- Alloy Tube.

4. AWWA Standards: C500 - Metal-Seated Gate Valves for Water Supply Service.
5. AWS A5.8 - Specification for Filler Metals for Brazing.
6. NFPA Standards:
   a. 13 - Installation of Sprinkler Systems.
   b. 14 - Installation of Standpipe and Hose Systems.
   c. 24 - Installation of Private Fire Service Mains and their Appurtenances.
   d. 25 - Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
   e. 230 - Fire Protection of Storage.
7. UL:
   c. 262 - Gate Valves for Fire Protection Service.
   d. 312 - Check Valves for Fire Protection Service.
   e. 668 - Hose Valves for Fire Protection Service.
   f. 753 - Alarm Accessories for Automatic Water-Supply Control Valves for Fire Protection Service.
   g. 789 - Indicator Posts for Fire Protection Services.

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

A. System layout and design responsibility are included as work of this Section.
1. Details of construction, quantities, components and accessories indicated on the Drawings and in the specifications are minimum requirements.
2. Minimum design criteria are as specified herein and as indicated on the Drawings.
3. Confirm final design requirements with the authority or authorities having jurisdiction and the Owner's insuring agency.
4. Increases in system component requirements beyond these minimums that are determined by the system designer to be necessary to provide the functional intent and for a complete system shall not be a basis for an increase in cost to Owner.
5. Final Design:
   a. The equipment and piping sizes and selections, where indicated on the Drawings, are minimum requirements and have been determined through the application of good engineering practice and standard calculation methods based on the best information available at the time that these documents were produced. A complete layout and hydraulic analysis has not been done.
   b. It is the responsibility of Contractor to verify all assumptions and design elements used as the basis of the preliminary design and to perform final calculations, sizing and selections as necessary to comply with the performance criteria specified herein and NFPA 13.
   c. The primary water source, and only the primary water source (the supply pipe size and, if applicable, fire pump size and selection and water storage) as indicated in these documents is to be used as the basis for Bid. If, after completion of complete hydraulic analysis, a material change in any or all of the components of the primary water source is required, an adjustment in the Contract will be considered only after all layout and sizing options have been considered.
  1) A fire pump is not expected to be necessary to meet the requirements of this project. All layout and sizing options must be evaluated by hydraulic analysis before a pump will be considered.
  d. A 10% margin of safety shall be included.

B. Intent of Contract Documents:
1. Indicate general areas to be sprinklered.
2. Indicate primary water service location and size.
3. Indicate flow and pressure test data used as basis for Drawings.
4. Indicate riser and standpipe locations.
5. Do not indicate complete system requirements.
6. Do not necessarily indicate all incidental areas, such as attics, platforms and adjacent concealed spaces as may be required to be sprinklered.
C. Sprinkler System Layout:
   1. Sprinkler piping shall consist of straight tree, side feed tree, looped, or gridded configurations.
   2. Straight tree, side feed tree and looped configurations may be designed according to pipe schedule system or hydraulically calculation.
   3. Gridded configuration shall only be designed according to hydraulic calculation.

D. Occupancy Hazard Fire Control Approach:
   1. Water demand requirements shall be determined from the occupancy hazard fire control approach in accordance with NFPA 13:
      a. Special design approaches are allowed only in accordance with the provisions of NFPA 13.
   2. Occupancies or portions of occupancies shall be classified according to the quantity and combustibility of contents, the expected rates of heat release, the total potential for energy release, the heights of stockpiles, and the presence of flammable and combustible liquids.

E. Protection Area Limitations: Maximum coverage per occupancy hazard shall be as indicated below:
   1. Light Hazard: 52,000 square feet.

1.5 SUBMITTALS

A. Preliminary Design Submittal:
   1. Provide in its entirety the following information:
      a. Name of Owner and occupant.
      b. Location, including street address.
      c. Point of compass.
      d. Building construction, obstructed versus unobstructed.
      e. Sprinkler spacing and location on reflected ceiling plans.
      f. Water Supply:
         1) One or more adequate hydrants.
         2) Existing Water Mains: Size, type and location.
         3) New Water Connections and Mains: Size, type and location.
         4) Hydrant flow test conducted within the last 6 months: Location, elevation, seasonal low, date and time of test.
      g. Design Approaches, Plans, and Calculations:
         1) Most remote demanding area coverage.
         2) Density.
         3) C-factor for pipe.
         4) K-factor for sprinkler head orifice.
         5) Minimum flow, discharge pressure, water supply curve.
         6) Hydraulic calculations.
         7) Scaled plans of piping system with pipe sizes and node numbering indicated.
      h. Sprinklers:
         1) Style.
         2) Temperature.
         3) Finish and coating.
      i. Hangers:
         1) Maximum distance.
         2) Proper type for structure and pipe size.
      j. Pipes and Fittings:
         1) Correct joints for pipes.
         2) Fitting pressure rating.
         3) Special corrosion resistant piping.
         4) Sleeves through floors and walls.
      k. Valves:
         1) Control Valves: Type, locations, and supervision.
         2) Drains: Size, type, and adequacy.
         3) Inspectors test.
2. Obtain Approval From:
   a. Agency and authorities having jurisdiction.
   b. Including, but not limited to:
      1) Owner’s insurer.
      2) State Fire Marshal.
      3) Local authorities.
3. Do not submit to approval agency until Engineer has reviewed the submittal. Engineer’s comments shall be incorporated into Drawings submitted to approving agency.

B. Final Design Submittal:
   1. Submit 8 sets, 2 of which shall bear approving agency stamp.
   2. Submit attached letter of explanation explaining in detail all of Engineer’s comments noted on preliminary submittal that have not been incorporated in final submittal.
   3. Should Engineer not accept letter of explanation stated above, incorporate comments into resubmitted final submittal at no additional cost to Owner.

C. Engineer’s Design Submittal Review: Review of preliminary and final submittals does not relieve Contractor of responsibility for design and compliance with regulatory requirements and those of the Contract Documents.

D. Pressure Test Reports:
   1. Submit within 1 week after each system pressure test.
   2. List time, date and persons present for the following for each system:
      a. Initial tests.
      b. Final tests.
   3. Include report indicating:
      a. Test type and duration.
      b. Initial pressure.
      c. Final pressure.
   4. Indicate that necessary repairs and final tests were satisfactorily completed.

1.6 QUALITY ASSURANCE

A. Qualifications:
   1. Installation Subcontractor: Certified by the state in which the work is performed.
   2. Fabrication and Installation Personnel:
      a. Trained and experienced in the fabrication and installation of the materials and equipment.
      b. Knowledgeable of the design and the reviewed submittals.

B. System installation and components shall comply with:
   2. NFPA 14.

C. System testing shall comply with NFPA 25.

D. Comply with requirements of the following agencies:
   1. Owner’s insurer.
   2. State Fire Marshal.
   3. Local authorities having jurisdiction.

E. Agency Approvals: All components critical to operation or otherwise required by NFPA or the Owner’s insurer shall be documented for compliance with the following:
   1. Underwriter Laboratories listed.
   2. Factory Mutual approved.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unbroken, brand marked containers or wrapping as applicable.
B. Handle and store materials in a manner which will prevent deterioration or damage; contamination with foreign matter - each end of pipe shall be capped, plugged or taped; or damage by weather or elements; and in accordance with Manufacturer's directions.

C. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

1.8 SEQUENCING AND SCHEDULING

A. Contractor's attention is called to ductwork, heating and cooling piping, water and drain piping, and electrical systems. Coordinate these systems to avoid conflict in elevations of the systems where same may cross each other. Determine which trade shall start work first on project.

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:
      a. Finished, wall-mounting, steel cabinet with hinged cover, with a minimum of 6 spare sprinklers plus sprinkler wrench.
      b. Include number of sprinklers required by NFPA 13 and sprinkler wrench.

PART 2 - PRODUCTS

2.1 PIPE, FITTINGS, AND HANGERS

A. Above Ground Pipe and Fittings:
   1. Pipe:
      a. Steel Pipe in Accordance with ASTM A135, or ASTM A53:
         1) Welded: Schedule 40.
         2) Threaded or Cut Groove:
            a) Schedule 40 for sizes less than 8 inches.
            b) Schedule 30 for sizes 8 inches or larger.
   2. Fittings:
      a. All steel, cast iron, and ductile iron fittings used on galvanized piping shall be galvanized.
      b. Standard weight steel, butt weld type conforming to ANSI B16.9 and ASTM A234.
      c. Screwed Fittings:
         1) Permitted in pipe sizes 2 inches and smaller.
         2) Conforming to ANSI B16.3 or B16.4, as applicable, and ASTM A197.
      d. Extra Heavy Pattern (Required When Pressures Exceed 175 psi):
         1) Standard weight cast iron fittings 2 inches and smaller are acceptable if pressures do not exceed 300 psi.
         2) Standard weight malleable iron fittings 6 inches and smaller are acceptable if pressures do not exceed 300 psi.
         3) Grooved pipe couplings and fittings as specified in Division 21 Sections "Steel Pipe and Fittings for Fire Suppression."

B. Flexible Connectors: Not allowed.

C. Hangers and Supports: Comply with requirements of Division 21 Section "Hangers and Supports for Fire Suppression Piping and Equipment" for selection of pipe hangers and supports.

D. Bending - Schedule 40 and Type K and L Copper:
   1. 2 inches and smaller pipe requires radius of 6 pipe diameters.
   2. 2-1/2 inches and larger pipe requires radius of 5 pipe diameters.
E. Return Bends:
   1. Return bends are required on all non-potable water systems.
   2. Grooved pipe couplings and fittings as specified in Division 21 Section “Steel Pipe and Fittings for Fire Suppression.”

2.2 SPRINKLER SPECIALTY FITTINGS

A. Fittings: UL listed or FM approved, with 175 psig minimum working pressure rating, and made of materials compatible with piping. Fittings shall be manufactured by factory; no field fabricated fittings are allowed.

B. Sprinkler Drain and Alarm Test Fitting: Cast or ductile iron body with threaded or locking lug inlet and outlet, test valve, and orifice and sight glass Manufacturers:
   1. Fire-End and Croker Corporation.
   2. Tyco Fire Products.
   4. Victaulic Company of America.

C. Sprinkler Branch Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler Manufacturers:
   1. Elkhart Brass Manufacturing Company, Inc.
   2. Fire-End and Croker Corporation.
   3. Potter-Roemer; Fire-Protection Division.

D. Sprinkler Inspector's Test Fitting: Cast-or ductile-iron housing with threaded inlet and drain outlet and sight glass Manufacturers:
   1. AGF Manufacturing Company.
   2. Triple R Specialty of Ajax, Inc.
   3. Tyco Fire Products.

2.3 SPRINKLER HEADS

A. UL listed with 175 psig minimum pressure rating.

B. Manufacturers:
   1. Viking.
   2. Grinnell.
   3. Reliable Corporation.

C. Bulb: Temperature rating of temperature activated color coded glass bulbs or fused link plates in accordance NFPA 13 or as dictated by authority having jurisdiction.

D. Mounting and Finish:
   1. In areas with suspended ceilings, provide concealed type sprinklers with cover plate factory-finished in off-white baked enamel, or flat black enamel in area with black ceilings.
   2. In areas without suspended ceilings, heads shall be bronze finish, up-right type.
   3. Bronze finish pendent heads may be used in Storage Rooms and Janitor's Closets.
   4. Provide and install sprinkler guards when sprinkler subject to mechanical injury or when ceiling is at 7'-0" or less to finished floor.
   5. Sidewall chrome plated sprinklers for extended coverage or as required: Restrain wall-mounted sidewall sprinkler to prevent movement.

2.4 VALVES

A. UL listed or FM approved with a 175 psig minimum pressure rating.
Wayne State University
Prentis Building Computer Lab Relocation
WSU Project Number 022-313456
FTCH Project Number 180746

B. Interior Valves:
1. Manufacturer:
   a. Grinnell.
   b. Kennedy.
   c. Nibco.
   d. Stockham.
2. 2-1/2-Inch and Larger: Cast iron, flanged, IBBM gate, or butterfly valves.
3. 2 Inches and Smaller: Bronze gate valves.
4. UL 262.

C. Sectional Control Valve(s):
1. Manufacturer: East Jordan Iron Works Series A18; or equal.
2. Gate valve with nonrising stem, mechanical joint 1 end and flanged joint opposite end.
3. Provide three-section cast iron adjustable valve box and cover at grade.

D. Post Indicator Valve(s):
1. Manufacturer: Kennedy Valve Figure 71X; or equal by Grinnell, Nibco or Stockham.
2. Gate valve with cast iron body mechanical joint ends, bronze mounted, nonrising stem and parallel seats.
3. Provide indicator post equal to Kennedy Figure 541 complete with wrench for each post.

2.5 ALARMS

A. Manufacturers:
1. Grinnell.
2. Gamewall.
3. Honeywell.
4. Autocall.
5. Reliable Auto. Sprinkler.

B. Valve Supervisory Switches: UL 753.

2.6 HOSE CONNECTIONS

A. Manufacturers:
1. Elkhart Brass.
2. Croker.
5. Potter-Roemer.
6. Tyco.

B. Description: UL 668, 300 psig minimum pressure rating, brass, hose valve for connecting fire hose:
1. Include 90 degree angle pattern design, female NPS inlet and male hose outlet, and lugged cap, gasket, and chain.
2. Include NPS 2-1/2 as indicated, and hose valve threads according to NFPA 1963 and matching local fire department threads.
3. Valve Operation:
   a. Non-adjustable type.
   b. Pressure regulating type where indicated or required.
5. Flow restricting devices: NPS 2-1/2 brass, adjustable for NPS 2-1/2 fire hose inlet.
PART 3 - EXECUTION

3.1 PREPARATION

A. System Layout:
1. The extent of sprinkler systems and general arrangements of overhead piping shall be as indicated on approved Shop Drawings.
2. Deviations there from may be made as required by inspection agencies, insuring agencies or as required due to interference with other equipment, structural members, ducts, etc., and shall be at no additional cost to Owner.
3. Provide additional heads as may be required for an approved system.
4. Distance from sprinkler to wall shall not exceed 1/2 of the allowable distance between sprinklers.
5. Small room rule: Small room rule may be executed when occupancy hazard has been determined as light hazard, unobstructed construction exists and the room does not exceed 800 square feet.
6. Shafts:
   a. Install 1 sprinkler at the top of the shaft, except if noncombustible, non-accessible duct shaft, electrical shaft or pipe shaft:
      1) If combustible surfaces, install sprinkler at each alternate floor level.
      2) If accessible and noncombustible, install one sprinkler at top and bottom.
7. Stairways: Sprinkler shall be located beneath all stairways of combustible construction:
   a. If noncombustible shaft, provide sprinkler at the top of the shaft and under first landing.
   b. If landing is serving 2 or more separate fire divisions, locate sprinklers at the same level as the landing and as required at each landing.

B. Conflicts:
1. Report discrepancies or conflicts discovered to Engineer.
2. Do not proceed with work until a satisfactory resolution is found.
3. No additional compensation will subsequently be made interferences due to Contractor's negligence, error, oversight or other cause in not having properly established the elevations of all new or existing piping.

C. Access and Protection: Notify General Contractor of any parts of the system requiring additional measures to provide access or to protect from freezing or damage.

3.2 APPLICATION SCHEDULE

<table>
<thead>
<tr>
<th>Application</th>
<th>Design Temperature Range</th>
<th>Maximum Pressure</th>
<th>Acceptable Pipe/Coupling (See Note Below)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Wet standpipe</td>
<td>-30 to 230 degrees F</td>
<td>300 psig</td>
<td>A</td>
</tr>
<tr>
<td>2. Wet pipe sprinklers</td>
<td>-30 to 230 degrees F</td>
<td>300 psig</td>
<td>A</td>
</tr>
</tbody>
</table>

Note - Pipe/Coupling Types:
A. Standard weight steel pipe.

3.3 INSTALLATION

A. Sprinkler Heads:
1. Location:
   a. Locate sprinkler heads in suspended ceilings symmetrical with lights, diffusers, and ceiling tile layout. Conceal piping in ceiling space.
   b. Locate sprinkler heads in the center of lay-in ceiling tiles.
   c. Head locations must be reviewed by Engineer prior to installation.
   d. Identify to Contractor any heads that may become subject to freezing or damage.
2. Special Coatings for Sprinkler Heads:
   a. Non-Corrosive Environments:
      1) Unless applied by the Manufacturer, sprinklers shall not be painted, and all sprinklers that
         have been painted shall be replaced with new listed sprinklers of the same characteristics,
         including orifice size, thermal response, and water distribution. Exception: Factory-applied
         paint or coating to sprinkler frames shall be permitted in accordance with NFPA 13.
      2) Ornamental finishes shall not be applied to sprinklers by anyone other than the sprinkler
         Manufacturer, and only sprinklers listed with such finishes shall be used.
   b. Sprinkler heads in foyer shall be mounted in the sidewall of the bulkheads - not exposed.

B. Piping:
   1. Piping shall be concealed in areas with ceilings and bulkheads and exposed in areas without ceilings.
   2. Support:
      a. Piping shall be installed and supported in accordance with NFPA 13.
      b. All sprinkler piping shall be supported from the building structure.
      c. Hanger spacing shall be in accordance with NFPA 13.
      d. Hanger rod size shall be in accordance with NFPA 13.
      e. Maximum unsupported length between the end sprinkler and the last hanger shall be in
         accordance with NFPA 13.
      f. Cross mains shall be supported by at least 1 hanger between each 2 branch lines.
      g. As a minimum, risers in buildings with ceilings over 25 feet high shall be supported at each riser
         pipe section. In multi-story buildings support risers at lowest level, at each alternate level above,
         below offsets and at the top of risers.
      h. Hangers in general are covered in NFPA 13. If the system is other than a standard water sprinkler
         system, the applicable NFPA Standard shall also be consulted.
   3. Cutting and Grooving:
      a. All flexible pipe fittings including grooved, cut and plain end and all quick fit fittings shall be
         installed with a machine specifically designed for this purpose.
      b. All piping to be grooved and cut shall be prepared using this specifically designed machine.
   4. Drainage:
      a. Install piping to allow for drainage.
      b. Provide drains at base of risers, on valved sections, at siamese connections and at other locations
         for complete drainage of system.
      c. Pipe drains to floor drain, service sinks, hub outlets or as approved.
   5. Penetrations: Comply with the requirements of Division 21 Section “Penetrations for Fire Suppression”
      and Division 07 Section “Penetration Firestopping.”

C. Inspectors Test Station:
   1. Provide inspector test connections.
   2. Pipe to outside of building or some other location where water damage will not result.

3.4 STANDPIPE INSTALLATION

A. Install standpipe system as indicated.

B. Hose connections shall be within easy reach of a person standing on the floor but in no case shall be over
   6 feet from the floor.

C. Install a pressure reduction device at hose valve outlet to restrict required flowing water pressure to 100 psi
   on floors.

D. Install fire department hose and test header connections.

E. Support lateral runs which are over 1-1/2 feet in length from standpipe to shoe valve by hangers.

F. Support horizontal runs according to NFPA 13.
3.5 PIPING SYSTEM PRESSURE TEST

A. General:
1. Perform all tests before piping is painted, covered, concealed or backfilled.
2. Before testing, remove or otherwise protect from damage, control devices, air vents, fixtures, meters, or other parts which are not designated to withstand test pressures.

B. Test Procedures:
1. Charge with water to the pressure specified.
2. Exterior Surface of Pipe and Fittings:
   a. Show no cracks or other form of leaks.
   b. Completely drip dry.

C. Pressure Test Criteria: Test criteria below are minimum requirements. In addition, the requirements of State and Local Codes having jurisdiction shall be met:
2. Type Test: Water.
4. Allowable Pressure Drop: 0 psi
5. Minimum Test Duration: 2 hours.

3.6 PAINTING AND LABELING

A. Painting of this work is limited to the exposed pipe, fittings and hangers. Do not paint sprinkler heads.

B. Provide labels as specified in Division 21 Section "General Fire Suppression Provisions." Comply with OSHA "Safety Color Code for Marking Physical Hazards".

END OF SECTION 21 10 00
SECTION 22 05 00 – GENERAL PLUMBING PROVISIONS

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 specifying the general requirements for execution of that portion of the Work defined in Division 22 of these Specifications and as indicated on the Drawings:
   1. Major items include, but are not necessarily limited to:
      a. Cutting and patching.
      b. Concrete foundations and support steel.
      c. Piping, fittings and valves.
      d. Piping and equipment insulation.
      e. Temperature and pressure gages.
      f. Plumbing equipment.
      g. Demolition of existing plumbing work.
      h. Labor, materials, equipment, tools, supervision and start-up services.
      i. Instructions to Owner regarding operation.
      j. Incidental and related items necessary to a complete and functionally operational installation of the Work.

B. Division of Work: In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the Work to be performed by specific trades. The following are suggestions as to how the Work may be divided. This is not a complete list of all the Work:
   1. General Contractor:
      a. Install access doors.
      b. Provide concrete isolation and housekeeping pads for plumbing equipment.
      c. Refer to Division 01 Section “Cutting and Patching.”
      d. Provide access doors in walls and ceilings for access to plumbing equipment.
   2. Plumbing Subcontractor:
      a. Refer to Division 01 Section “Cutting and Patching.”
      b. Furnish location, size and quantity of openings to Contractor before construction of new walls, ceilings, and floors.
      c. Furnish size and locations of concrete equipment isolation and housekeeping pads as required for this Work and as indicated on the Drawings to Contractor before slabs are poured.
      d. Furnish size and location of access doors required for this work as indicated on the Drawings to Contractor.
      e. Provide miscellaneous structural steel required in connection with support of the Work of Division 22.
      f. Perform final cleaning of plumbing systems and equipment.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of Division 22 shall comply with the following:
   1. ANSI:
   2. ASME: B31.9 - Building Services Piping.
5. Michigan:

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

A. Construction details, components, accessories, sizes and model numbers indicated on the Drawings or in these specifications are used to indicate minimum levels of quality and coordination requirements.

B. Equipment supplied, whether as scheduled or selected from list of acceptable Manufacturers, must meet minimum requirements listed in specifications or on Drawings, be compatible with facility and intended use, and meet requirements for a functional system.

C. Drawings:
   1. Are diagrammatic and indicate general arrangement of systems and work included.
   2. Do not necessarily indicate every required valve, fitting, thermometer, gage, duct, elbow, transition, turning vane, mounting support and access panel.
   3. Shall not be scaled for measurement or installation location.
   4. Shall not serve as Shop Drawings.

D. Schedules and model numbers shall not be used to:
   1. Serve as final, definitive quantity requirements. Contractor shall make own count as indicated on Drawings.
   2. Determine proper type or model with arrangement, mounting and accessories applicable.

E. Coordinate installation work of Division 22 with work of other trades to provide a complete and functional system. Generally, the location of ductwork, sanitary, storm and vent piping take precedence over fire protection and HVAC piping, electrical conduit and cable trays.

1.5 SUBMITTALS

1.6 QUALITY ASSURANCE

A. Comply with all State and Local requirements.

B. All products and components that conveys or dispenses water for human consumption through drinking or cooking must comply with US SWDA – 2014, NSF 61- 2012, and NSF 372-2011. Compliance must be certified and labeled by an independent accredited testing agency.

1.7 PRODUCT UNLOADING AND HANDLING

A. Unload equipment and materials required for completion of the Work.

B. Handle and store equipment and materials carefully to prevent damage. Method of rigging and handling shall be subject to the approval of an authorized representative of the equipment Manufacturer whose equipment is being handled.

1.8 TROUBLESHOOTING

A. By Contractor: If, during the start-up or warranty period, mechanical systems operational problems occur for which the root cause is not readily apparent, Contractor shall promptly, through a Subcontractor or other resource designated by Subcontractor, provide diagnostic and investigative services to determine the cause or causes.
B. By Engineer:
   1. At Contractor's request, Engineer will provide the services necessary to determine the cause or causes of the operational problems.
   2. Under the provisions of the General Conditions, Engineer will also provide these services if Contractor fails to respond satisfactorily to operational problems within a reasonable time after written notice from Engineer.
   3. If while working at Contractor's request or under the provisions of the General Conditions, Engineer determines that the problems are due to failure of the Work to comply with the requirements of the Contract Documents, Owner will compensate Engineer for additional services and deduct the amount paid from payment or payments to Contractor.

1.9 MAINTENANCE

A. Special Tools: Where special tools are required for operation, furnish these to Owner.

B. Loose and Detachable Parts:
   1. Retain loose and small detachable parts of the apparatus and equipment furnished until the completion of the Work.
   2. Turn over these parts to Owner.

C. Construction Strainers:
   1. Remove after flushing and cleaning and prior to turn over to Owner.
   2. Attach removed construction strainer to piping where removed as proof of removal.

PART 2 - PRODUCTS

2.1 FABRICATIONS

A. Miscellaneous Structural Steel:
   1. Structural steel work shall be done in accordance with the AISC Specification for Design, Fabrication and Erection of Structural Steel for Buildings, except that allowable stresses shall be reduced 25%.
   2. Where required, high strength structural steel bolting conforming to ASTM Specification A325 and assembled to AISC "Specifications for Assembly of Structural Joints. Using High Strength Steel Bolts" or welding shall be used in place of rivets.
   3. Connections shall be properly designed for the type of connection and the loads to be carried, and shall be subject to Engineer's or Owner's approval.
   4. Welding shall be done by operators who have been previously qualified by tests as prescribed in the American Welding Society "Standard Qualification Procedure" to perform the type of work required.
   6. Finished members shall be true to line and free from twist, bends and open joints.

B. Material installed in a ceiling plenum shall be either noncombustible or have a maximum flame spread of 25 and a maximum smoke developed rating of 50.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Character of Work: Installation shall be executed in a workmanlike manner and shall present a neat mechanical appearance when completed.

B. Laying Out of Work:
   1. Layout piping, equipment and components in accordance with the Contract Documents and the Manufacturer's recommended practice, including provision of adequate space for maintenance. Review layout with Engineer prior to installation.
2. Check drawings of other trades to verify spaces in which work will be installed. Maintain maximum head room and space conditions at all points. Where head room or space conditions appear inadequate, notify Engineer before proceeding with installation.

3. If directed by Engineer, Contractor shall make reasonable modifications in the layout as required to permit proper execution of the Work and to prevent conflict with work of other trades.

4. Work shall be installed so as to be ready for operation, maintenance and repair. Minor deviations from Drawings may be made to accomplish this. Changes shall not be made without approval of Engineer.

3.2 MODIFICATIONS TO EXISTING FACILITIES

A. Comply with the requirements of Division 02 Section “Selection Demolition” for removal of existing pipes, equipment, and other systems.

B. Comply with the requirements of Division 02 Section “Selective Demolition,” for all work related to the modification, alteration, conversion, renovation and reuse of existing facilities.

3.3 PIPE FITTINGS

A. Provide insulating couplings or unions where dissimilar materials are joined.

B. Provide unions at valves and at equipment for making repairs.

3.4 PAINTING

A. Paint exposed, non-insulated piping in accordance with the requirements of Division 09 – Finishes.


C. Valves, Fittings, and Supports:
   1. Paint valves and fittings the same base color as the pipe they adjoin.
   2. Paint floor stands the same base color as the pipe they adjoin.
   3. Paint wall brackets and pipe hangers the same base color as the wall or ceiling they adjoin, or gray, if wall or ceiling is not painted.

3.5 CODING AND TAGGING

A. Piping:
   1. Applied to new piping after installation, insulation, and final painting.
   2. Conform to Owner’s existing standards or conventions.
   3. Markings:
      a. Painted on, 1-inch high black letters.
      c. Directional arrow.
   4. Place markers at:
      a. 20-foot centers with at least 1 in each room.
      b. Near each valve and control device.
      c. Near locations where pipes pass through wall or floors/ceilings, or enter non-accessible enclosures.
      d. At access doors, manholes and similar access points which permit view of concealed piping.
      e. Near major equipment items and other points of origination and termination
      f. Every change in direction.
      g. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
      h. On piping above removable acoustical ceilings, except omit intermediately spaced markers.
   5. Plastic coated “Set Mark-Snap-Around” pipe markers manufactured by Seton Name Plate Corp. or Brady Co., may be used in lieu of painted markers and bands.
B. Valves:

1. Brass Valve Tags: Provide 19 gage polished brass valve tags with stamp engraved piping system abbreviation in 1/4-inch high letters and sequenced valve numbers 1/2-inch high, and with 5/32-inch hole for fastener.
   a. Provide 1-1/2-inch diameter tags, except as otherwise indicated.
   b. Provide size and shape as specified or scheduled for each piping system.

2. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

3. Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures.

4. Furnish schedule(s) of tagged valves with number, location (room or space utilizing WSU's official room numbering scheme), piping system abbreviation (as indicated on tag) and purpose of each valve. Provide schedule typewritten and reproduced on 8-1/2-inch x 11-inch bond paper.

5. Place a copy of each schedule:
   a. In the Maintenance Instructions.
   b. Mount on the wall in Mechanical Room at location directed by Owner.
   c. For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

C. Where valves are located above the ceilings, a cadmium plated screw or such marking as designed by Engineer shall be located in the ceiling tile directly below the device.

D. Equipment:

1. Provide for:
   a. Each major item of mechanical equipment and each operational device.
   b. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   c. Strainers, filters, and similar equipment.
   d. Meters, gages and similar units.
   e. Labeled with its tag name/number as given on the Drawings.
   f. Use 2-inch high stenciled painted lettering.

2. Similarly label control components associated with the above named equipment items.

3.6 START-UP

A. Comply with the requirements of Division 01 Section “Starting and Adjusting.”

3.7 ADJUSTING

A. Adjust and align equipment for smooth operation:
   1. Plumb true and with parts in proper position and alignment.
   2. Rotating parts shall turn freely and in the correct direction.
   3. Flexible couplings shall be checked for alignment subject to Owner's approval.
   4. Follow Manufacturer's instructions.

B. The work of installation shall be executed in conformity with the best practice, so as to contribute to efficiency of operation, minimum noise or vibration, minimum maintenance, accessibility and sightlines.

3.8 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:
   1. Provide when required by individual Section.
   2. Provide the following services except where indicated otherwise in individual Sections:
      a. Inspect, check and approve system installation.
      b. Supervise system start-up.
c. Provide written report indicating that system:
   1) Has been properly installed and lubricated.
   2) Is in accurate alignment.
   3) Is free from undue stress imposed by connecting lines or anchor bolts.
   4) Has been satisfactorily operated under full load conditions.
d. Demonstrate operation of system to Owner's personnel.
e. Instruct Owner's personnel on operation and maintenance of system.

B. Performance Test:
   1. Test the entire Work, including all of its individual systems for 2 weeks before final payment will be made.
   2. Every phase of plumbing plant shall be operated separately, or in conjunction one with the other to demonstrate to Engineer the ability of the plant to meet capacity and performance requirements while maintaining design condition, in accordance with the true intent and purpose of these Specifications.
   3. Make final tests in the presence of Owner and Engineer.
   4. If a part of the Work or equipment does not meet Specifications:
      a. Correct the situation.
      b. Obtain approval of Engineer before final payment is made.
   5. Provide the personnel and bear costs for correcting malfunctions.
   6. Owner will provide operating personnel and utilities.

C. Comply with the requirements of Division 01 Section “Starting and Adjusting.”

3.9 CLEANING AND FINISHING

A. Comply with the requirements of Division 01 Section “Cleaning and Waste Management.”

B. Entire installation shall be free from surface oil and grease before work will be considered for final payment.

C. After tests have been made and the system pronounced tight:
   1. Clean piping and equipment.
   2. Lubricate bearings.

D. Final cleaning includes but is not limited to the following:
   1. Equipment with Factory Finishes:
      a. Wash factory-finished equipment with mild soap and water and leave in first-class condition, entirely free of stains or streaks.
      b. Do not use abrasive materials. Touch up scratches or other violations of the factory finish paint with matching paint from the equipment Manufacturer prior to cleaning.
   2. Plumbing Fixtures:
      a. Clean with mild soap and water containing a disinfecting agent.
      b. Set trim handles at same angle and polish.
      c. Remove, clean and reinstall aerators.
      d. Check pop-up wastes for proper operation.
   3. Clean sumps, pits, trenches, manholes, catch basins and floor drains and leave free of foreign material.

END OF SECTION 22 05 00
SECTION 22 05 06 – CAST IRON PIPE AND FITTINGS FOR PLUMBING

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 basic requirements of all cast iron pipe and fittings. Refer to Division 22 Section “Plumbing Piping and Specialties” for project specific requirements.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:

1. ASTM Specifications:

2. Cast Iron Soil Pipe Institute (CISPI) Specification:
   b. 310 - CISPI's Patented Joints for Use in Connection with Hubless Cast Iron Sanitary System.

3. AWWA Standard:
   c. C151 - Ductile Iron Pipe Centrifugally Cast in metal Molds or Sand Lined Molds for water or other liquids.
   d. C153 - Ductile Iron Compact Fittings, 3-inch through 24-inch.

1.4 SUBMITTALS

A. Submit in accordance with Division 01 Section “Submital Procedures.”

B. Manufacturer's Literature: For cast iron pipe and fittings and couplings. Includes Manufacturer name, Manufacturer location, dimensions, and details of construction and installation.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the installation of the material.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

B. Regulatory Requirements: Comply with local code applicable to installation of the material.

PART 2 - PRODUCTS

2.1 HUB AND SPIGOT PIPE AND FITTINGS – BELOW GROUND PIPING

A. ASTM A74, Service class.
   2. Coated cast iron.
   3. “Push tight” resilient joints and fittings.
B. Gaskets:
   1. ASTM C 564.
   2. Elastomeric double seal compression type.

C. All pipe and fittings shall be made in the United States and bear the CISPI trademark.

2.2 HUBLESS PIPE AND FITTINGS – ABOVE GROUND PIPING

A. ASTM A888 and CISPI 301.
   1. Service weight.

B. Couplings:
   1. ASTM C1277 Couplings.
   2. ASTM C1540 Heavy Duty Couplings.
   3. Corrosion resistant fasteners.
   4. ASTM C564 rubber sleeve with integral, center pipe stop.
   5. Above Ground:
      a. Heavy Duty, Type 304, Stainless Steel Couplings: ASTM A666, Type 304, stainless steel shield; stainless steel bands; and sleeves.
         1) NPS 1-1/2 to NPS 4 (DN 40 to DN 100): 3-inch wide shield with 4 bands.
         2) NPS 5 to NPS 10 (DN 125 to DN 250): 4-inch wide shield with 6 bands.

C. All pipe and fittings shall be made in the United States and bear the CISPI trademark.

PART 3 - EXECUTION

3.1 ERECTION

A. System shall be installed in accordance with Manufacturer's instructions and Code requirements.

B. Hubless piping shall not be used for pressurized applications.

3.2 JOINTS AND FITTINGS

A. Mitered joints will not be permitted.

B. Joints between CI soil pipe and "DWV" (drain, waste and vent) copper pipe are to be made with calking ferrule for bell and spigot pipe or a compatible adapter for hubless pipe.

C. Pipe and fittings shall be joined by 1 of the following 2 methods:
   1. Positive double seal elastomeric compression type gasket.
   2. No hub clamp assembly.

D. Service weight pipe shall be joined with service weight gasket.

END OF SECTION 22 05 06
SECTION 22 05 09 – COPPER PIPE AND FITTINGS FOR PLUMBING

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 basic requirements of copper pipe and fittings. Refer to Division 22 Section “Plumbing Piping and Specialties” for project specific requirements.

1.3 REFERENCES
A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASTM Specifications:
      a. B75 - Copper Fittings.
      b. B88 - Seamless Copper Water Tube.
      c. B306 - Copper Drainage Tube (DWV).

1.4 SUBMITTALS
A. Manufacturer’s Literature: For domestic hot and cold water pipe. Include material, properties, dimensions, details of construction and installation, name of Manufacturer, model.
B. Manufacturer’s literature for couplings and gasketing material.

1.5 QUALITY ASSURANCE
A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.
   3. Installer of mechanical coupling piping system must be able to demonstrate a minimum of 5 years successful installation experience.
B. Testing of Copper Piping: In accordance with Division 22 Section “Testing and Cleaning of Plumbing Systems.”

1.6 DELIVERY, STORAGE AND HANDLING
A. Deliver materials in original, unbroken, brand marked containers or wrapping as applicable.
B. Handle and store materials in a manner which will prevent deterioration and contamination with foreign matter.
C. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace removed materials at no additional cost to Owner.
PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Seamless Copper Tubing:
   1. Factory coded and marked.
   2. Conform to the following schedule:
      a. Aboveground: ASTM B88, Type L, hard drawn.
      b. Buried: ASTM B88, Type K soft temper.
      c. Drainage: ASTM B306, Type DWV.
   3. Pipe Markings:
      a. All piping longer than 2'-0" shall have a permanent marking in accordance with ASTM or ANSI specifications.
      b. This identification shall include the following:
         1) Manufacturer's name.
         2) Pipe pressure rating.
         3) Pipe size.

B. Solder type shall conform to the following schedule:
   1. Hot and cold water and recirculation lines: 95% tin, bismuth, copper and 5% silver.
      a. IAPMO listed lead free.
   2. Drain Piping: 50% tin and 50% lead.
   3. Condensate Drain Piping: 50% tin and 50% lead.

C. Fittings:
   1. General Service: Sweat type, wrought copper, long radius elbows.
   2. Drainage:
      a. Sweat type, wrought copper, drainage pattern.
      b. Specialty items, such as closet elbows, may be cast brass.

PART 3 - EXECUTION

3.1 PREPARATION

A. During Freezing Weather:
   1. Protect all materials in such a manner that no harm can be done to:
      a. Installations already made.
      b. Materials and equipment on the Site.
   2. Furnish all necessary protection for such installations and equipment as may be required.

3.2 ERECTION

A. General:
   1. All Piping: Follow approved paths as indicated on the Drawings.
   2. Connect to existing lines where required, or to equipment in an approved manner.
   3. Locate Pipes, Valves and Equipment to Provide:
      b. Minimum obstruction of passageways and working space.
   4. Normally, all pipe runs shall be plumb, parallel with the building and level, except for drain slope.
   5. Be responsible for establishing and maintaining drain slope of piping in order to ensure drainage.
   6. Expansion of Piping:
      a. All pipe connections shall provide freedom of movement of the piping during expansion and contraction without springing of piping or injury to building steel or structure.
      b. Any damage to building steel or structure as a result of work installed by Contractor shall be repaired at Contractor's expense.
   7. As Piping Material is Erected:
      a. Thoroughly clean the inside of all piping.
      b. Remove foreign material such as scale, sand, weld spatter, particles and cutting chips.
8. Provide caps or plugs in all openings at the end of each day's work and as otherwise directed for the protection of the piping.

B. Pipe Joints:
   1. Cut ends of copper tubing squarely using only sharp tube cutters.
   2. Ream pipe to full I.D. before preparing the joint.
   3. Soldering:
      a. Solder or braze joints by cleaning outside ends of all copper tubings and inside of fittings immediately before joining and soldering.
      b. Apply solder flux to both tube and fitting.
      c. Insert tube full depth into fitting, apply heat and solder in such a manner as to draw solder into and completely around the joint.
   4. Joining Valves:
      a. When joining copper lines to valves follow Manufacturer's instructions.
      b. In general:
         1) Valve shall be in the fully open position.
         2) Solenoid and expansion valves shall be broken down.

3.3 FIELD QUALITY CONTROL

A. Clean and test piping in accordance with Division 22 Section “Testing and Cleaning of Plumbing Systems.”

B. Manufacturer’s Field Service: Arrange and pay for Manufacturer’s engineer to provide the installation direction for a minimum onsite time of 1 day.
   1. Submit written approval of installation.

END OF SECTION 22 05 09
SECTION 22 05 23 – GENERAL DUTY VALVES FOR PLUMBING

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 furnishing and installation of all valves.

1.3 REFERENCES

A. Except as specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. General: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features as determined by Installer for installation requirements. Comply with ASME B31.9 for building services piping, and ASME B31.1 for power piping.
   5. Flangeless: Valve bodies manufactured to fit between flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

A. General:
   1. This Section is provided as a guide in the application and specification of specific valves intended for use in this Project. This Section does not instruct where to install these valves unless specifically noted. Refer to other specific Plumbing Specification Sections and Drawing details for instruction for location and use.
   2. As indicated on the Drawings.
   3. As called out in the Piping Systems Schedules.

B. Valves not specifically indicated on the Drawings:
   1. Size and class of valve to agree with line in which installed.
   2. All valves 2-1/2-inch and larger shall be flanged unless noted otherwise.

C. Valves shall have Manufacturer's name, trademark and working pressure rating cast into the valve body.

1.5 SUBMITTALS

A. Shop Drawings for all valves.

B. Manufacturer's Literature: For All Valves:
   1. Manufacturer's name.
   2. Details of construction.
   3. Performance characteristics.

1.6 QUALITY ASSURANCE

A. Made in USA:
   1. Unless specifically noted otherwise, all valves shall comply with the Federal Trade Commission Made in USA standard.
   2. Supplier shall furnish documentation of USA content if requested by Engineer.
B. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the material and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Valves shall be manufactured by one Manufacturer for each type of valve. Where valve Manufacturers are not specifically indicated, they shall be one of the following:
   1. Nibco.
   2. Kennedy.
   3. Crane.
   7. Grinnell.
   8. Mueller Steam Specialties
   10. DeZurik.
   11. Hammond.
   12. Apollo.
   13. Watts

2.2 MATERIALS

A. Bronze Valves:
   1. All brass alloys used in valves shall contain no more than 15% zinc.
   2. Alloys must comply with ASTM B61, B62 or B584.

2.3 HAND VALVES

A. General:
   1. Provide extended stem handles with a minimum clearance of 1-1/2-inch on insulated service.
   2. All valves used for throttling/balancing shall have adjustable memory stops.
   3. Pressure ratings are at service indicated by application.

B. Gate Valves:
   1. Valves used for piping 2-1/2-inch in size and larger shall be IBBM, OS&Y, bolted bonnet, rising stem, solid wedge, bronze mounted, flanged ends, and designed for 125 pounds.
   2. Based on Nibco F-617-O for 2-1/2 inches or larger.

C. Ball Valves:
   1. Ball valves used in connection with piping 2 inches in size and smaller shall have screwed or sweat ends, 3 piece stainless steel body, full port with stainless steel ball and a like stem. VA rated for 150 pound SWP and 600 WOG. Seats and seals shall be virgin teflon for standard duty cycle. Provide reinforced teflon for applications identified for extended duty cycle.
   2. 3 inches and larger shall be flanged or butt welded.

D. High Performance Butterfly Valves:
   1. Butterfly valves 2-1/2 inches in size and larger, shall be high performance lug-type, ANSI Class 150, suitable for continuous duty in 150 psig, 250 degrees F, carbon steel body, stainless steel shaft, stainless steel disc, PTFE seat with Teflon stem packing, and fully bi-directional on dead-end service, double flanged body construction.
   2. Provide rotary manual actuators as specified above.
   3. In accordance with ANSI B16.5, 31.34 Construction for Body Components B31.1, 31.3 ASME Section VII, IX.
   4. Disc movement relative to shaft rotation shall be double offset design.
5. Stem holding to clear required installation thickness.
6. Have open position memory stop.
7. Manually operated butterfly valves 4 inches and larger shall have enclosed worm gear operators with position indicator.

E. Drain Valves: Furnish at each low point 3/4-inch ball valves as specified above. Install nipple with cap at valve outlet.

F. Plug Valves:
1. Plug valves shall be nonlubricated eccentric plug type rated for 175 CWP with iron body neoprene coated plug and epoxy coated seat; equal to DeZurik PEC or Homestead Series 300. Furnish with compatible wrench. All valves used for throttling/balancing to have adjustable memory stop.
2. Plug valves (gas cock) for natural gas shutoff applications shall be lubricated type equal to Homestead Figure 611 or 612 or Rockwell Figure 114 or 115.

2.4 CHECK VALVES

PART 3 - EXECUTION

3.1 VALVE APPLICATION SCHEDULE

A. Cold Water, Hot Water and Hot Water Return System:
1. Isolation through 2-inch: Ball Valve.
2. Isolation 2 1/2-inch and Larger: High Performance Butterfly Valve, All stainless steel.

3.2 INSTALLATION

A. Install valves in conformance with:
1. The Shop Drawings reviewed by Engineer.
2. The Manufacturer's recommendations.

B. Install Valves:
1. At all branch piping connection to mains.
2. At all connections to equipment.
3. As required for complete control or isolation of any piece of equipment or service to branch lines.
4. In accessible locations.
5. Equal in flow area to connecting piping, unless otherwise indicated.

C. No valve shall be installed with its stem below the horizontal.

D. Furnish chain operated hand wheels, including rust-proof chain and chain guide for inaccessible overhead valves.

E. Install flanged valves at equipment in a manner which allows equipment side of valve to be opened up without draining piping system.

END OF SECTION 22 05 23
SECTION 22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

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 furnishing and installation of all pipe hanging and support systems.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASME - American Society of Mechanical Engineers:
      a. B31.9 - Building Services Piping.
   2. MSS - Manufacturers Standardization Society:
      b. SP-69 - Pipe Hangers and Supports - Selection and Application - 1996.
      c. SP-90 - Guidelines on Terminology for Pipe Hangers and Supports.

1.4 DEFINITIONS

A. Pipe Restraint: Pipe supporting element which is designed to limit or direct pipe movement due to internal static pressure, gravitational forces, frictional forces from hangers, rollers, and guides, and forces from expansion compensation devices:
   1. Pipe restraints are not designed to restrain pipe movement caused by thermal expansion, shock or surge.

B. Pipe Guide: A pipe restraint designed to direct pipe movement along a single axis.

C. Pipe Anchor: A pipe restraint designed to provide a static point about which pipe movement normally occurs, by limiting the longitudinal and axial movement at that point.

D. Other Terms: As defined in MSS SP-90.

1.5 DESIGN AND PERFORMANCE REQUIREMENTS

A. Unless otherwise indicated on Drawings or in these Specifications, this Contractor shall be responsible to design and provide all pipe hangers, supports, restraints, braces, framing, etc., as required to comply with all applicable building codes, ASME B31 and MSS SP-69.

B. Comply with the requirements of ASME B31.8 for pipe hangers and support of natural gas piping systems.

1.6 SUBMITTALS

A. Manufacturer's Literature: For structural steel attachment devices, hangers and rollers. Include name of Manufacturer; model number and MSS Type, if applicable; and piping systems to be used with.
PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The materials of all pipe hanging and supporting elements shall be in accordance with the latest requirements of the ASME Code for Pressure Piping B31.1 and MSS Standard Practice MSS SP-58 and MSS SP-69 except as supplemented or modified by the requirements of these Specifications.

B. The material in contact with the pipe shall be compatible with the piping material so that neither shall have a deteriorating action on the other.

C. Special Finishes and Materials:
   1. All ferrous hangers and supports used in the following areas shall be hot dip galvanized unless noted otherwise:
      a. Outside.
      b. In wet or potentially wet areas.
      c. All areas where installed for piping and equipment that will not have field-applied coatings.
   2. Pipe attachments shall have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing or shall be copper plated to achieve similar metal contact.
   3. Thermal Hanger Shield Inserts: 100-psi average compressive strength, waterproofed calcium silicate, encased with a sheet metal shield. Insert and shield shall cover entire circumference of the pipe and shall be of length indicated by manufacturer for pipe size and thickness of insulation.

2.2 MANUFACTURERS

A. Elcon.

B. Michigan Hanger.

C. Anvil.

D. Bergen.

E. Hilti.

F. Lindapter.

G. Thybar

H. Pate

I. Mirro

J. Roof Products and Systems

K. A.E.S.

L. MicroMetl.

2.3 PIPE HANGERS AND SUPPORTS

A. Horizontal Piping Hangers: Unless otherwise indicated and except as specified in piping system Specification sections, install the following types:
   1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).
   2. Yoke Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 degrees F (49 to 232 degrees C) pipes, NPS 4 to NPS 16 (DN100 to DN400), requiring up to 4 inches (100 mm) of insulation.
3. Carbon or Alloy Steel, Double Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN20 to DN600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN15 to DN600), if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN15 to DN100), 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 (DN20 to DN200).

7. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).

8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).

9. Adjustable Swivel Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN15 to DN50).

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 (DN10 to DN200).

11. Extension Hinged or 2 Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN10 to DN80).

12. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30 (DN15 to DN750).

13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

B. Supports and Rollers:

1. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast iron floor flange.

2. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast iron floor flange with U-bolt to retain pipe.

3. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion type support for pipes, NPS 2-1/2 to NPS 36 (DN65 to DN900), if vertical adjustment is required, with steel pipe base stanchion support and cast iron floor flange.

4. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN25 to DN750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.

5. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN65 to DN500), from single rod if horizontal movement caused by expansion and contraction might occur.

6. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN50 to DN1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

7. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN50 to DN600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

8. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN50 to DN750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

C. Vertical Piping Clamps: Unless otherwise indicated and except as specified in piping system specification 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 (DN20 to DN500).

2. Carbon or Alloy Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500), if longer ends are required for riser clamps.

D. Hanger Rod Attachments: Unless otherwise indicated and except as specified in piping system specification sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 degree F (49 to 232 degree C) piping installations.

3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type II, 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 degree F (49 to 232 degree C) piping installations.
E. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification 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 (32 mm).
   3. Spring Cushion Roll Hangers (MSS Type 49): For equipping Type 42 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% 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% 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% 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 1 trapeze member.

2.4 HANGER RODS

A. Minimum rod diameters for rigid rod hangers shall be as shown in MSS SP-69 Table 4 (Minimum Rod Diameter for Single Rigid Rod Hangers) and as indicated in Part 3 of these Specifications.

B. Hanger rods shall be subject to tensile loading only. At hanger locations where lateral or axial movement is anticipated, suitable linkage shall be provided to permit swing.

C. Rod material must be compatible with hanger and comply with above. Do not field cut thread on galvanized rod.

D. Do not use perforated strap.

E. Multiple Supports:
   1. Horizontal banks of pipe may be supported on a common base member without regard to the pipe centerline elevation.
   2. In the supporting of multiple pipe runs, provisions shall be made to keep the lines in their relative lateral positions, using clamps or clips as required. Lines subject to thermal expansion shall be free to roll axially or slide.

2.5 SADDLES AND SHIELDS

A. All Piping:
   1. Saddle: MSS Type 39 Anvil Figure 160 to 165.
   2. The saddles shall be tack welded in place and filled with insulation equal to that of the adjacent piping.
   3. Shield: MSS Type 40 (Anvil Figure 167), provide and install in accordance with Manufacturer's shield size selection tables.
   4. The contour of the saddle shall match the radius of the pipe insulation.
   5. Thermal Hanger Shield Inserts: 100 psi average compressive strength, waterproofed calcium silicate, encased with a sheet metal shield. Insert and shield shall cover entire circumference of the pipe and shall be of length indicated by manufacturer for pipe size and thickness of insulation.

2.6 ALIGNMENT GUIDES

A. Provide at all expansion loops and joints:
   1. As indicated on the Drawings.
   2. As required to maintain alignment.
   3. In accordance with Expansion Joint Manufacturer's Association recommendations.
4. Factory fabricated, of cast semisteel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

B. Pipe Slides and Guides:
1. Manufacturer:
   a. Advanced Thermal Systems, Inc.
   b. As approved by Owner.
2. Model:
   a. Figure 101-W for guide weld down applications.
   b. Figure 101-B for guide bolt down applications.
   c. Figure 201-W for slide weld down applications.
   d. Figure 201-B for slide bolt down applications.
3. Size: Appropriate for pipe size, insulation thickness and length of travel.
4. Minimum Length of Travel:
   a. For the first 1/4 of the distance from the anchor to the expansion joint -25% of design travel length of joint.
   b. For the second 1/4 of the distance from the anchor to the expansion joint -50% of design travel length of joint.
   c. For the third 1/4 of the distance from the anchor to the expansion joint -75% of design travel length of joint.
   d. For the last 1/4 of the distance from the anchor to the expansion joint - design travel length of joint +25%.

C. Spider Type Guides:
1. Manufacturers:
   a. Anvil.
   b. Pentair - ERICO.
   c. Keflex.
2. Anvil, Figure 255; 256, or equal.

2.7 FABRICATED STEEL SUPPORTS AND RESTRAINTS

A. Provide as required:
   1. Steel shapes and plates.
   2. Bolts.
   3. Welds.

B. Materials and fabrication in accordance with:
   2. AISC Code of Standard Practice for Steel Buildings and Bridges (except Section 4.2.1.).

C. Design: Responsibility of Subcontractor.

D. Paint all finished fabrications:
   1. As specified in Division 09 Section “Painting.”
   2. Color as directed by Owner.

2.8 MANUFACTURED METAL FRAMING SUPPORT SYSTEMS

A. Acceptable Manufacturers:
   1. Bee Line.
   2. Elcen.
   3. Super Strut, Inc.

B. Provide products from one Manufacturer.
C. Components shall have galvanized coatings where installed for piping and equipment that will not have factory or field-applied finish.

D. Channel (Standard Applications):
   1. Mild strip steel.
   2. 12-gage minimum material.
   3. Factory painted equal to Unistrut Perma-Green.
   4. Equal to Unistrut Part No. P1000.

E. Clamps and Supports:
   1. Beam clamp equal to Unistrut Part No. P2785.
   2. Pipe strap equal to Unistrut Part No. P2558.
   3. Pipe roller equal to Unistrut Part No. P2474.
   4. All items fabricated in material equal to channel specifications.
   5. Copper pipes supported on metal framing support channels shall be protected from galvanic corrosion by special insulators between the pipe clamp and the channel.

F. Clamp Nuts:
   1. Mild bar steel for standard applications.
   2. Class 2 American Standard threads.
   3. Equal to Unistrut Part No. P1012.

2.9 BUILDING ATTACHMENTS

A. As indicated on the Drawings or in the Specifications.

B. Concrete Attachments:
   1. Provide galvanized finish for all attachments.
   2. Poured Concrete:
      a. Use cast-in-place inserts or bolted surface mounted attachments, at Contractor’s option.
      b. Expansion style anchors are not permitted on piping systems subject to vibration.
   3. Precast Concrete Tees:
      a. Use fittings specifically designed for attachment to stems of precast tees.
      b. Drilling is not permitted except where specifically approved by Engineer and coordinated with precast Manufacturer to miss embedded, prestressed steel strands.
   4. Precast Concrete Plank:
      a. Use toggle bolt attachment as indicated on Drawings.
      b. Alternatively, provide adhesive anchor, Hilti HY-20; or as approved.
      c. Drilling is not permitted except where specifically approved by Engineer and coordinated with precast Manufacturer to miss embedded, prestressed steel strands.

C. Horizontal Piping:
   1. Steel W, I, or S shapes: MSS Type 23 clamp with retaining clip, (Anvil Fig. 88, Fig. 89) up to 2-inch; MSS Type 28 (Anvil Fig. 292) or MSS Type 21 (Anvil Fig. 133, 134) above 2-inch.
   2. Steel Channel: MSS Type 20 universal channel clamp.
   3. Bar Joists: Steel washer plate (Anvil Fig. 60).
   4. Concrete: See “B” above.
   5. Timber: Angle bracket and lag screws or as detailed on Drawings.
   6. Steel Z Shapes: Custom attachment required.

D. Vertical Piping:
   1. Steel Shapes: Welded brackets as approved by Engineer.
   2. Concrete: See “B” above.
   3. Timber: Ceiling hanger flange (Anvil Fig. 128R, 153) angle brackets and lag screws, or as detailed on Drawings.

E. In the absence of a Specification for a particular type of attachment, furnish attachments comparable in type and quality to that specified above for a similar situation.
PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. General Requirements:
1. The selection of pipe hangers and supports shall be based on the overall design concept of the piping system and any special requirements which may be called for in these Specifications or as indicated on the Drawings. The support systems shall provide for, and control, the free or intended movement of the piping including its movement in relation to that of the connected equipment. They shall prevent excess stress resulting from the transfer of weight being introduced into the pipe or connected equipment.
2. The selection of hangers and supports shall be made to provide the piping system with the degree of control that its operating characteristics require.
3. The selection of hangers or supports will take into consideration the combined weight of the supported systems, including system contents and test water.
4. Select and install hangers and supports to allow controlled thermal and seismic movement of piping system, to permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends and similar units.
5. The spans in MSS SP-69 Table 3 do not apply where concentrated weights, such as valves or heavy fittings, or where changes in direction of the piping occur between hangers.
6. Select all hangers and supports rated for the maximum potential loading with pipe full.
7. Select hangers for cold (less than 50 degrees F) piping service for installation over the insulation.
8. Where significant, vertical movement of pipe occurs at the hanger location a resilient support must be used:
   a. Selection of resilient supports shall be based on permissible load variations and effects on adjacent equipment. Support selection for typical load variations are shown on MSS SP-69 Table 2 (Spring Support Selection). Load and movement calculations shall be made for the proper selection of spring hangers.
   b. Vertical movement and load transfer from riser expansion to horizontal runs shall be given consideration when applying spring hangers.
   c. Spring cushion hangers may be used where vertical movement does not exceed 1/4-inch and where formal load and movement calculations are not required.
   d. Variable spring hangers shall be used for all other resilient support requirements except as noted in the following paragraph.
   e. Constant support hangers shall be used on piping systems where the deviation in supporting force must be limited to 6% and which cannot be accommodated by a variable spring hanger.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification sections.

3.2 HANGER AND SUPPORT INSTALLATION

A. Pipe Hanger and Support 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.

B. General:
1. Adjust all components as required for proper operation and required pipe slope.
2. Double nut all support rods at hangers.
3. Location and Routing:
   a. Install Piping as Indicated:
      1) On the Drawings.
      2) On the reviewed Shop Drawings.
   b. Secure Engineer's approval for all pipe routing changes.
4. Coordinate with other trades for placement of concrete attachments prior to concrete pouring.
5. Install all items in accordance with Manufacturer's instructions.

C. Support at Valves: Provide additional supports at all valves in piping 4-inch and larger.
D. Vertical Risers:
1. Support independently from adjacent hangers on horizontal piping.
2. Cast Iron Waste, Vent or Drainage Piping:
   a. Support at the base and at each floor level.
   b. Support spacing not to exceed 15-foot centers.
3. Copper Piping:
   a. Support at the base and at 6-foot maximum centers for sizes 1-1/4-inch and smaller.
   b. Pipes Larger Than 1-1/4-Inch:
      1) Supported at each floor level.
      2) Not to exceed 10-foot centers.
4. Vertical Threaded, Welded or Grooved Steel Piping:
   a. Support at the base of the riser and at every other floor.
   b. Maximum allowable unsupported piping length is 12 feet.

E. Horizontal Runs:
1. General:
   a. Provide adequate supports for the loads with a factor of safety of at least 5 (400 pounds minimum).
   b. Provide protective shield at all hangers and rollers supporting plastic pipe and coated pipe.
   c. Support spacing not to exceed MSS SP-69 Table 3, or the requirements in the table below, whichever is more stringent.
   d. Hanger rod diameter shall not be less than the requirements of MSS SP-69 Table 4, or the requirements in the table below, whichever is more stringent.
2. Rollers: All piping systems designed to accommodate thermal expansion movement shall be mounted on rollers.
3. Bar Joists: Attachments to bar joists shall be made to top member and at panel points.

F. Ductile Iron Piping: The size of hanger components shall be suitable for the O.D. of the pipe to be supported.

G. Cast Iron Soil Piping:
1. The size of hanger components shall be suitable for the O.D. of the pipe to be supported.
2. Spacing shall comply with MSS SP-69 Table 3.

H. Hanger Spacing:
1. Install hangers and supports for piping at intervals specified herein after, at locations not more than 3 feet from the ends of each runout, and not over 25% of specified interval from each change in direction of piping.
2. Hanger Spacing:
<table>
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<tr>
<th>Material</th>
<th>Maximum Hanger Spacing</th>
<th>Steel Rod Size</th>
<th>Copper Pipe Size</th>
<th>Water Pipe Size</th>
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<td>5'</td>
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<tr>
<td>Cast Iron Soil Pipe</td>
<td>10'-0&quot;, but not less than one support per pipe joint</td>
</tr>
</tbody>
</table>
3.3 PIPE RESTRAINTS

A. Provide adequate pipe restraints for all expansion or contraction of piping due to temperature change:
   1. Including, but not limited to, that indicated on the Drawings.
   2. As instructed by Owner or Engineer.
   3. At locations to prevent stresses from exceeding those permitted by ANSI B31 and to prevent transfer of
      loading and stresses to connected equipment.
   4. Spacing: Unless otherwise indicated, install at ends of main pipe runs, at intermediate joints in pipe
      runs between expansion loops and bends.

B. Concrete work installed in connection with anchors or supports: Make with approved Portland Cement:
   1. At least 5-1/2 bags per cubic yard.
   2. Properly mixed with approved aggregate.
   3. Attain a compression strength of not less than 3,000 psi at 28 days.

3.4 VIBRATION ELIMINATORS

A. Provide as indicated on the Drawings and in accordance with the requirements of Division 22.

B. Install so as to cause minimum restraint to normal thermal movements.

3.5 INSULATION PROTECTION

A. Provide Protection Saddle:
   1. Equal to insulation thickness.
   2. At each hanger.
   3. For all insulated piping systems where longitudinal expansion exceeds 1-inch per 100 feet.

B. Provide preservative treated wood block "saddle" for all insulated domestic cold water piping systems larger
   than 3-inch IPS. Anvil Fig. 160 to 165 is also acceptable.

C. Provide insulation protection shield:
   1. At each hanger for all "cold" (less than 50 degrees F) piping services.
   2. In accordance with the following table:

<table>
<thead>
<tr>
<th>Pipe Size (IPS)</th>
<th>Shield Gage</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>5&quot; and Smaller</td>
<td>16</td>
<td>12&quot;</td>
</tr>
<tr>
<td>6&quot; to 12&quot;</td>
<td>12</td>
<td>16&quot;</td>
</tr>
<tr>
<td>Greater than 12&quot;</td>
<td>12</td>
<td>20&quot;</td>
</tr>
</tbody>
</table>

   3. Installed as follows:
      a. Surround lower covering.
      b. Straddle equidistant on hanger.
      c. Flared at both ends as required to avoid damage to pipe covering, jacket and vapor barrier.

3.6 PAINTING

A. Touchup: Cleaning and touchup of painting of field welds, bolted connections and abraded areas of shop paint
   on miscellaneous metal are specified in Division 09 Section “Painting.”

B. Galvanized Surfaces: Clean welds, bolted connections and abraded areas. Apply galvanizing repair paint to
   comply with ASTM A780.

END OF SECTION 22 05 29
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 furnishing and installation of the major items listed below:
   1. Pipe sleeves.
   2. Sealing and finishing of all mechanical openings.
   3. Provide UL rated firestopping and sealing at all new and existing pipe penetrations of fire rated walls.

B. Division of Work: In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the work to be performed by specific trades. The following are suggestions as to how the Work may be divided. This is not a complete list of all the work:
   1. General Contractor:
      a. Locate and place all sleeved and framed openings as part of constructing the wall and floor surfaces in which the openings occur.
      b. Provide all lintels and required stiffening members for wall and floor openings.
   2. Mechanical Subcontractor:
      a. Advise General Contractor of quantity, location and size of all required openings.
      b. Provide all curbs, sleeves, seals, escutcheons and related materials required for finishing and sealing mechanical openings. Furnish all flashing and counterflashing.
      c. Arrange and pay for all openings required after wall and floor construction is complete.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the Work of this Section shall comply with ASTM D2202 - Test Method for Slump of Sealants.

1.4 SUBMITTALS

A. Manufacturer's Literature: For all premanufactured curbs and sealing assemblies.
   1. Manufacturer's name.
   2. Model number.
   3. Details of construction and installation.
   4. Certified load-bearing data for all curbs.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed submittals.

B. Codes and Standards: "Architectural Sheet Metal Manual" as published by SMACNA.

C. Openings in Fire-Rated Surfaces: As specified in Division 07 Section “Penetration Firestopping.”
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Prefabricated Stack Sleeve Assemblies:
   1. Josam.
   2. Wade.
   3. Zurn.

B. Backer Rod: Industrial Thermo Polymers, “Standard Backer Rod”.

2.2 MATERIALS

A. Backer Rod:
   1. Extruded round, closed cell, polyethylene foam.
   2. Resilient, non-exuding.
   3. Density: 2.0 pounds per cubic foot.
   4. Tensile Strength: 50 psi.
   5. Nonabsorbent to water and gasoline.
   6. Suitable for use as a backing for acoustical sealant.
   7. Compatible with sealant and approved by sealant Manufacturer.

B. Fire-Rated Penetrations: Permanently flexible, approved firestop putty. Refer to Division 07 Section “Penetration Firestopping.”

C. Packing Material for Penetrations:
   1. Glass Fiber or Mineral Fiber:
      a. Noncombustible.
      b. Resistant to water, mildew, and vermin.
   2. Expanding Resilient Foams:
      a. Acceptable alternative if manufactured for this purpose.
      b. Minimum material density: 60 pounds per cubic foot.

2.3 SLEEVES

A. Materials:
   1. 18-Gage Galvanized Steel: For pipe penetrations in non-bearings walls.
   2. Schedule 40 Steel Pipe:
      a. For all bearing walls.
      b. For all floors.

B. Size All Sleeves:
   1. To allow for movement due to expansion.
   2. To provide for continuous insulation, except as required by Division 07 Section “Penetration Firestopping.”
   3. As indicated on the Drawings.

2.4 MANUFACTURED UNITS

A. Stack Sleeves and Flashing Fittings:
   1. Provide as required for floor pipe penetrations.
   2. Equal to Josam 264xx series products.
PART 3 - EXECUTION

3.1 INTERIOR WALL AND FLOOR OPENINGS

A. Flash all floor-mounted drains except in slabs on grade:
   1. Use integral flashing flange and clamp.

B. Use riser sleeve with integral flashing flange and clamp for all waterproof membrane floors.

C. Seal airtight all openings around pipes in the structure at:
   1. Mechanical equipment rooms.
   2. All enclosed shaft penetrations.

D. Pipe Penetrations:
   1. Domestic Water, Drain and Vent Piping:
      a. Where a pipe passes through a wall, ceiling, or floor slab, cast or grout a steel sleeve into the structure.
      b. Internal diameter of the sleeve: 2 inches (50 mm) larger than the external diameter of the pipe passing through it.
      c. After all of the piping is installed in a specific area, check the clearance and correct it, if necessary, to within 1/2-inch (12 mm).
      d. Pack the void full depth with packing material and seal at both ends, 1-inch (25 mm) deep.
      e. Where pipes pass through a masonry wall in sufficient numbers and density that individual pack-and-calk details are not possible, a special isolation detail shall be developed:
         1) Cast pipe sleeves in a block of concrete with the sleeves located a minimum of 2 inches (50 mm) apart.
         2) Block thickness: At least as thick as the surrounding wall construction.
         3) Each sleeve diameter: 2 inches (50 mm) larger than the external diameter of the pipe passing through it.
         4) Build the sleeved block into the wall.
         5) After the pipes are installed, pack and caulk voids as indicated above.

3.2 ESCUTCHEONS AND CLOSURE COLLARS

A. Includes ceilings, partitions, floor and walls.

B. Provide Escutcheons for All Piping:
   1. Sized to fit over coverings.
   2. In All Dry Finished Areas: Chrome plated.
   3. As indicated on the Drawings.

END OF SECTION 22 05 31
SECTION 22 05 33 - HEAT TRACING FOR PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.

1.2 SCOPE OF WORK
   A. Furnish and install a complete UL listed system of heaters, components, and controls to prevent pipelines from freezing. Refer to drawings for additional scope clarification.

1.3 COORDINATION
   A. The heat tracing and all the necessary accessories shall be furnished and installed by the Mechanical Contractor. Electrical Contractor shall provide power supply and related wiring by the per Division 26, and as shown on electrical drawings.

1.4 MANUFACTURERS
   A. Raychem.
   B. Thermon.
   C. Delta Therm Inc.

PART 2 - PRODUCTS

2.1 MATERIAL
   A. Electric heat tracing shall be self-limiting type suitable for temperature maintenance up to 40 degrees F.
   B. The heater shall have a self-regulating factor of at least 90 percent. (the percentage reduction, without thermostatic control, of the heater output going from 40 degrees F pipe temperature operation to 150 degrees F pipe temperature operation).
   C. The heater shall operate on line voltages of (select: 120, 208 or 220) volts without the use of transformers.
   D. The heater shall be sized according to this table. The required heater output rating is in watts per foot at 50 degrees F. (Heater selection based on 1" fiberglass insulation on metal piping).

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Min. Ambient - 10 deg.F</th>
<th>Temp. - 20 deg. F</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&quot; or less</td>
<td>5 watt</td>
<td>5 watt</td>
</tr>
<tr>
<td>4&quot;</td>
<td>5 watt</td>
<td>8 watt</td>
</tr>
<tr>
<td>6&quot;</td>
<td>8 watt</td>
<td>8 watt</td>
</tr>
<tr>
<td>8</td>
<td>2 strips – 5 watt</td>
<td>2 strips – 8 watt</td>
</tr>
<tr>
<td>12&quot; - 14&quot;</td>
<td>2 strips – 8 watt</td>
<td>2 strips – 8 watt</td>
</tr>
</tbody>
</table>

   E. Connectors and fittings, and indicator lights, and other required installation accessories shall be manufacturers standard recommended for the freeze protection application. The heater shall include a tinned copper braided shield, electrically bonded at splice locations, and bonded to the branch circuit ground conductor at the power connection point.
   F. All the components and system shall be U. L. listed.

2.2 ELECTRICAL PROTECTION
   A. Provide ground fault circuit breakers or other ground fault protection with a 30 mA ground fault trip level. See Division 26 for more details.
2.3 CONTROLS

A. Provide heater system controls indicated below, and as shown in the drawings:
   1. Outdoor air thermostat control to prevent operation when outside air temperature is above 40F (adjustable).
   2. Heater failure alarm, using outdoor piping thermostats, and voltage detectors, with audible and visual alarm and alarm contact for remote monitoring by the owner's Energy Management System.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The entire installation shall comply with the manufacturer's instructions and all the applicable sections of NEC, latest edition.

B. The electrical and mechanical installation details shall strictly adhere to manufacturer's recommended practices. The manufacturer's representative shall supervise and test the installation and provide a letter to the Owner that the entire installation complies with their requirements, and the installation tested out satisfactorily.

3.2 TESTS

A. After heater installation and before and after installing the thermal insulation, subject heater to testing using a 1000 VDC megger. Minimum insulation resistance shall be 20 megohms regardless of length. Test both heating cable bus wires to verify the connection of any splices or tees.

B. After all megger testing and insulation is complete, manufacturer shall conduct functional performance test to ensure system is fully operational, and submit report.

END OF SECTION 22 05 33
SECTION 22 05 73 – TESTING AND CLEANING OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes providing testing and cleaning services and the major items listed below:
   1. Provide all pumps, gages, valves and other equipment and material necessary to properly conduct tests and perform cleaning.
   2. Arrange and pay for all costs of utilities and chemicals required for the Work.
   3. Repair and Restore All Work Damaged:
      a. By tests.
      b. By cutting required in connection with the tests.

1.3 SUBMITTALS

A. Flushing and Cleaning:
   1. Submit certificates for all code-required inspections.
   2. Submit all water Sample analysis reports as required in Part 3 of these Specifications.

B. Pressure Test Reports:
   1. Submit within 1 week after each system pressure test.
   2. List time, date and persons present for the following for each system:
      a. Initial tests.
      b. Final test.
   3. Include report indicating:
      a. Test type and duration.
      b. Initial pressure.
      c. Final pressure.
   4. Indicate that necessary repairs and final tests were satisfactorily completed.

1.4 QUALITY ASSURANCE

A. Comply with all applicable codes.

B. Secure State Health Department approval for potable water systems.

C. Testing and Cleaning Agency:
   1. Minimum 15 years' experience in providing cleaning chemicals for water systems use.
   2. Provide regional laboratory support services.

PART 2 - PRODUCTS

2.1 CLEANING AGENT MANUFACTURERS

A. Aqua-Chem.

B. Aquatrol.

C. Enerco.

D. Nalco.
2.2 MATERIALS

A. Detergents, solvents and other cleaning agents shall be compatible with materials of fabrication of systems where they are used. No cleaning agent shall adversely affect materials or mechanisms in systems and cleaning agents shall be acceptable to equipment manufacturers and the plant environmental coordinator.

B. Detergents, solvents and other cleaning agents shall be compatible with process streams to be handled by systems in which the cleaning agents are used.

C. Owner will provide water for pipe cleaning and flushing. Other cleaning fluids, agents, and equipment shall be provided by Contractor.

D. Provide the necessary temporary equipment required for cleaning and flushing operations.

E. Provide permanent hose connections for supply, discharge and recirculating lines for the new piping system.

F. Provide piping at the ends of the main and branch lines of the piping system as required to accomplish flush of the piping.

G. Provide a temporary pump of sufficient head and GPM required to achieve a flushing velocity of at least 10 feet per second.

H. Provide temporary chemical skids with tote tanks as required for mixing chemicals and serving as a source reservoir and/or collection point for cleaning and flushing solutions.

I. Provide temporary bag filters (with filter bags) as required for removal of contaminants from flushing process.

J. Provide all hose, electrical leads and supply connections for completion of system required to fill, drain and refill of the lines utilizing plant supplied water and power.

PART 3 - EXECUTION

3.1 PIPING SYSTEM PRESSURE TEST

A. General:
   1. Perform all tests before piping is painted, covered, concealed or backfilled.
   2. Before testing, remove or otherwise protect from damage, control devices, air vents, fixtures, meters, or other parts which are not designated to withstand test pressures.

B. Test Procedures:
   1. Water Test:
      a. Charge with water to the pressure specified.
      b. Exterior Surface of Pipe and Fittings:
         1) Show no cracks or other form of leaks.
         2) Completely drip dry.

C. Pressure Test Criteria:
   1. Test criteria below are minimum requirements. In addition, the requirements of State and Local Codes having jurisdiction shall be met:

<table>
<thead>
<tr>
<th>Piping System</th>
<th>Type Test</th>
<th>Pressure</th>
<th>Allowable Pressure Drop</th>
<th>Minimum Test Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage System</td>
<td>Water</td>
<td>5 psig</td>
<td>0 psi</td>
<td>30 Minutes</td>
</tr>
<tr>
<td>Vent System</td>
<td>Water</td>
<td>5 psig</td>
<td>0 psi</td>
<td>30 Minutes</td>
</tr>
<tr>
<td>Water (Domestic)</td>
<td>Water</td>
<td>100 psig</td>
<td>0 psi</td>
<td>4 Hours</td>
</tr>
</tbody>
</table>
3.2 FLUSHING AND CLEANING PROCEDURES

A. Preinstallation Cleaning:
   1. Before installation, unless otherwise specified, piping shall be cleaned as follows:
      a. Hammer, brush, scrub with soapy rags, to loosen sand, dirt, or scale when necessary. Remove excess grease and oil from exterior surface.
      b. Blow with air, or flush with clean water, and inspect before erection.
      c. Pipe cleaned and stored before installation shall be dried and ends sealed with a rigid plug or flange protector and tape.
      d. Physical cleaning procedures shall not damage materials or mar surfaces of such materials. Hammering shall not be used on cast iron, fiberglass-reinforced plastic, or plastic pipe.

B. Prior to Flushing:
   1. Items removed from piping system shall be cleaned separately.
   2. Lock valves in open position.
   3. Use new gaskets, thread lubricants when removed items are reinstalled after cleaning.

C. System Protection:
   1. Protect piping and equipment against overpressure, collapse from vacuum, and hydraulic shock during flushing and draining procedures.
   2. Exercise special care with initial filling of long pipe runs to determine that pipe is in contact with hangers and supports before filling. Piping bowed out of hangers or supports will settle or lengthen during filling and resulting forces may be damaging at changes in direction.
   3. Install high point vents and low point drains required to remove trapped air and to drain flushing liquid.

D. Domestic and Other Open Water Piping Systems: Flush with clean water until all foreign matter is removed.

E. Drain completely and refill after flushing.

3.3 POTABLE WATER PIPING DISINFECTION

A. Disinfect new or repaired potable water systems in accordance with the method prescribed by the local health authority or, in the absence of a prescribed method, in accordance with either AWWA C651 or AWWA C652 or in accordance with the current edition of the Michigan Plumbing Code as described below. This requirement shall apply to "on Site" or "in-plant" fabrication of a system or to a modular portion of a system.

B. Flush the piping system with clean, potable water until dirty water does not appear at any of the points of outlet. Coordinate disposal of all flushing and disinfecting water with the plant environmental coordinator. Install temporary hoses as required to reach existing disposal points, or collect the water in a portable tote tank for transfer to the proper disposal location.

C. Fill the piping with a water/chlorine solution containing at least 50 parts per million (50mg/L) of chlorine, and the piping shall be valved off and allowed to stand for 24 hours; or the piping shall be filled with a water/chlorine solution containing at least 200 parts per million (50mg/L) of chlorine, and allowed to stand for 3 hours; after which the chlorine level shall be tested.

D. Following the required standing time and testing, flush the piping with clean potable water until the chlorine is purged from all parts of the system piping.

E. A bacteria test by an independent agency shall be performed, after the chlorine test has passed. Based on the result from the bacteria test, potable water shall be opened for service. The procedure shall be repeated where shown by a bacteriological examination that contamination remains present in the system.

F. Submit water Sample to State Health Department for test and approval.

END OF SECTION 22 05 73
SECTION 22 07 19 – PLUMBING PIPING INSULATION

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 furnishing and installation of piping insulation.

1.3 REFERENCES:

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASTM Specifications:
      b. C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
      d. C552 - Cellular Glass Block and Pipe Thermal Insulation.

1.4 SUBMITTALS

A. Manufacturer's Literature:  For piping insulation.
   1. For Each Type Used:
      a. Name of Manufacturer.
      b. Details of construction and installation.
      c. Manufacturer's data (density, K-factor).
   2. For Each Application:
      a. Thickness.
      b. Total "R" value.
      c. Jacket material.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unbroken, brand marked containers or wrapping as applicable. Handle and store materials in a manner which will prevent deterioration and contamination with foreign matter.

B. Reject damaged, deteriorated, or contaminated material and immediately remove from the Site. Replace removed materials at no additional cost to Owner.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Insulation:
   1. Pittsburgh-Corning.
   2. Owens-Corning.
   3. Certainteed.
   4. Armacell.
   5. Rubatex.

2.2 TYPES OF INSULATION MATERIALS

A. Rigid Molded Glass Fiber – General (FG):
   1. All-service jacket (ASJ) type factory applied jacketing.
   2. 3 lbs/cu ft minimum density.
   3. k factor of 0.23 at 75 degrees F mean.
   4. 50 degree F service temperature.
   5. Owens-Corning Type ASJ Max Pipe Insulation with SSL Max closure system; or equal.
   6. Typical for application on pipes 16 inches and up.

2.3 PIPE AND FITTING COVERS

A. Polyvinyl Chloride (PVC) Covers:
   1. Ultraviolet resistant.
   2. 0.030-inch minimum thickness.
   3. Preformed to match outer diameter of insulation.
   4. Preformed fitting covers, minimum 10 mil.
   5. Ceel-Tite 330; or equal, by Topline or Zeston.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Install piping insulation:
      a. In conformance with the Drawings, these Specifications, and the Manufacturer's recommendations.
      b. After piping system has been satisfactorily tested.
      c. Over clean, dry piping system.
      d. To the following thickness:
         1) As specified herein or as indicated on the Drawings.
         2) If not specified herein or indicated on the Drawings, in accordance with Manufacturer's recommendations for the specific application.
      e. Continuous through walls, ceilings and sleeves except at fire stops.
   2. Repair or replace insulation damaged by:
      a. Demolition.
      b. Making connections to piping or equipment.
      c. Water or mildew.

B. Joints and Fittings:
   1. Block insulate valves and flanges with reusable insulation system.
   2. Insulate elbows, tube turns, sweeps and bends with mitered sections or premolded fittings. Match pipe covering material where used.
   3. Fit joints tightly together.
   4. Seal joints with sealing compound and preformed aluminum bands.
3.2 JACKETS AND FINISH

A. General:
1. Cap off ends with caps.
2. On cold lines, cut caps to the exact size of the pipe and seal with a recommended silicone calking.
3. Provide slip joints a minimum of every 25 feet or as needed for expansion.
4. Locate longitudinal jacket seams on indoor exposed piping out of view.

B. PVC:
1. Center a preformed strap (snap-strap) containing a permanently weatherproof plastic sealant over each circumferential joint and secure by tightening on a clip, or by use of a separate stainless steel banding.
2. Design snap-strap to take care of normal expansion.
3. Cover all pipe insulation and preformed insulation fittings.
4. Weld longitudinal seams together with welding adhesive as supplied by cover Manufacturer.
5. Overlap adjacent jacketing 3/4-inch and weld circumferential seams together with welding adhesive.
6. Overlap fitting covers to adjacent pipe insulation jacketing. Weld longitudinal and circumferential seams together with adhesive.

C. Taper and seal insulation ends regardless of service.

D. Fitting and pipe jackets to have matching finishes ready for painting.

3.3 PIPING INSULATION APPLICATION SCHEDULE

A. Basis of Thickness Chart:
1. Thicknesses shown are based on products having a maximum "k" factor of 0.26 at a mean temperature of 75 degrees F.
2. These Thicknesses:
   a. Can be reduced for products having significantly lower "k" values.
   b. Shall be increased for products having higher "k" values in order to produce equivalent or greater thermal resistance.

B. Flame/Smoke Ratings: Local requirements for flame and smoke ratings must be met and may exclude some options listed herein.

C. Jackets and Finish Application:
1. Provide PVC jacket on insulated piping located outside.

D. Thickness Chart (In Inches):
1. Key: Insulation Type (Refer to Paragraph 2.2 of this Section):
   a. FG = Rigid Fiberglass.

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>Domestic Hot Water</th>
<th>Domestic Cold Water/Non-Potable Cold Water</th>
<th>Cooling Coil Drain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piping Systems Type</td>
<td>Temp (F) Range</td>
<td>Less Than 1&quot;</td>
<td>1&quot; to 1-1/4&quot;</td>
</tr>
<tr>
<td>1. Domestic Hot Water</td>
<td>120-200</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>2. Miscellaneous</td>
<td>80-119</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>3. Domestic Cold Water/Non-Potable Cold Water</td>
<td>40-80</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>4. Cooling Coil Drain</td>
<td>--</td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

* See PART 2 – PRODUCTS Article 2.2 TYPES for types of insulation.
SECTIO
N 22 08 00 – COMMISSIONING OF PLUMBING

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 lists plumbing systems to be commissioned.

1.3 SYSTEMS TO BE COMMISSIONED

A. The following systems will be commissioned:

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 22 08 00
SECTION 22 10 00 – PLUMBING PIPING AND SPECIALTIES

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 furnishing and installation of all materials, labor, equipment, supervision, fees, and services incidental to proper completion of all plumbing system work:
   1. Domestic cold water system.
   2. Domestic hot water system.
   3. Interior waste and vent piping.
   4. Cooling coil condensate drainage system.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ANSI/ASME Standards:
      b. A112.1.2 - Air Gaps in Plumbing Systems.
      c. A112.21.1 - Floor Drains.
      d. A112.21.2 - Roof Drains.
      e. A112.36.2M - Cleanouts.
   2. ASSE (American Society of Sanitary Engineering) Standards:
      a. 1001 - Pipe Applied Atmospheric Type Vacuum Breakers.
      b. 1003 - Water Pressure Reducing Valves.
      c. 1011 - Hose Connection Vacuum Breakers.
      d. 1012 - Backflow Preventers with Intermediate Atmospheric Vent.
      e. 1013 - Reduced Pressure Principal Backflow Preventer.
      f. 1016 - Individual Thermostatic Pressure Balancing, and Combination Pressure Balancing and Thermostatic Control Valves for Individual Fixture Fittings.
      g. 1017 - Temperature Actuated Mixing Valves for Hot Water Distribution Systems.
      h. 1018 - Trap Seal Primer Valves – Potable Water Supplied.
      i. 1044 - Trap Seal Primer Valves – Drainage Type.
   3. ASTM Standards:
      a. A53 - Steel Pipe, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
      c. A181 - Carbon Steel Forgings for General Purpose Piping.
      d. A194 - Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
      e. A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
      f. A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
      g. A395 - Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
      h. A518 - Corrosion-Resistant High Silicon Iron Castings.
      i. B88 - Seamless Copper Water Tube.
      j. B306 - Copper Drainage Tube (DWV).
      k. C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
      m. D2136 - Test Method for Coated Fabrics - Low Temperature Bend Test.
      n. D2657 - Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
      q. D3034 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
r. D4101 - Propylene Plastic Injection and Extrusion Materials.

4. AWWA Standards:
a. C500 - Gate Valves for Water and Sewerage Systems.


1.4 SUBMITTALS

A. Manufacturer's Literature: For all products required in Part 2 of this Section:
   1. Required Information:
      a. General:
         1) Name of Manufacturer.
         2) Model number.
         3) Dimensions.
         4) Details of construction and installation.
   2. Not required for piping or hangers and supports.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

B. Regulatory Agencies Requirements:
   1. All state and local codes and ordinances shall have jurisdiction.
   2. All related electrical devices shall be housed in suitable enclosures as defined by the National Electrical Manufacturers' Association (NEMA).
   3. All gas-fired appliances and installation shall be in accordance with American Gas Association (AGA) guidelines.
   4. All components used in systems in contact with drinking water shall comply with the requirements of NSF 372 for lead free.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Comply with the requirements of Division 22 Sections “Cast Iron Pipe and Fittings for Plumbing” and “Copper Pipe and Fittings for Plumbing.”

B. Refer to schedules in Part 3 of this Specification for specific applications of pipe materials to plumbing systems.

C. Refer to Division 22 Section “Hangers and Supports for Plumbing Piping and Equipment” and the schedule in Part 3 of this Section for Hanger and Support Requirements for Plumbing System Piping.

2.2 SPECIALTIES

A. Pipe Guides:
   1. Manufacturer:
      a. ITT Grinnell.
      b. Michigan Hanger.
      c. Keflex.
   2. Type: Spider, P-series, Figure 25L.
   3. Minimum 12 inches long.
   4. Spacing: As indicated on Drawings or as required by Expansion Joint Association.
B. Shock Absorbers:
1. Furnish and install where indicated or wherever quick closing valves (including flush valves) are utilized. Shock absorbers shall be located and sized in accordance with Standard PDI-WH-201.
2. Manufacturer: Josam, Wade, or Zurn.

C. Dielectric Water Fittings:
1. Dielectric Couplings: Electroplated steel or brass nipple, with an inert and non-corrosive, thermoplastic lining.
2. Dielectric Unions: Provide dielectric unions with appropriate end connections for the pipe materials in which installed (screwed, soldered or flanged), which effectively isolates dissimilar metals, prevents galvanic actions and stops corrosion.

2.3 VALVES
A. General Duty Hand Valves: Refer to Division 22 Section “General Duty Valves for Plumbing” for valve construction and material requirements.
1. Valves Up to 2-inches:
2. Valves 2-1/2-inches and Larger: 125 lb IBBM OS&Y gate valve.
3. ASSE 1070 Point of Use Thermostatic Control Valve:
   a. Certified for compliance with ASSE 1070 for individual fixture temperature control.
   b. Shall use a wax filled thermostatic element to sense incoming temperature fluctuations and maintain leaving water temperature 3 degrees F of setpoint for flows down to 0.5 gpm.
   c. Construction:
      1) Cast bronze body.
      2) Stainless steel internal components.
      3) 125 psig rated working pressure.
   d. Provide tamper resistant setpoint adjustment.
   e. Provide with integral check valves.
   f. Watts USG-B, Wilkin.
4. ASSE 1017 Point of Source Thermostatic Mixing Valve:
   a. Certified for compliance with ASSE 1017 for point of source multiple fixture temperature control.
   b. Shall use a liquid filled thermostatic motor to maintain outlet temperature 3 degrees F within temperature fluctuations as defined by ASSE 1017 for flows down to 2 gpm.
   c. Construction:
      1) Cast bronze body.
      2) Stainless steel internal components.
      3) 125 psig rated working pressure.
   d. Provide tamper resistant setpoint adjustment.
   e. Provide with integral check valves.
   f. Powers Hydroguard Series 490, Conbraco 34A or 34C, or Leonard Type TM.
   g. Include in a surface mounted stainless steel cabinet with mixing valve, stop valve and union on hot and cold water, and temperature and pressure gages.

2.4 CLEANOUTS
A. Description:
1. Furnish and install cleanouts where indicated on drawings in accordance with the following table. Wade model numbers are for reference only.
2. Series floor cleanout with NH spigot outlet or ty-seal outlet connection, threaded adjustable housing, flanged ferrule with tapered brass plug and round or square nickel brass or ductile iron vandal resistant secured top for floor finishes as follows:

<table>
<thead>
<tr>
<th>Location</th>
<th>Wade Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfinished Concrete (Scoriated XH Di Top)</td>
<td>W-6000-Z</td>
</tr>
<tr>
<td>Carpet (Textured NB Top with carpet marker)</td>
<td>W-6000-CM</td>
</tr>
<tr>
<td>Asphalt and Vinyl Tile (Recessed NB Top)</td>
<td>W-6000-TS</td>
</tr>
<tr>
<td>Ceramic and Quarry Tile (Scoriated NB Top)</td>
<td>W-6000-XS</td>
</tr>
<tr>
<td>Terrazzo (Deep recessed NB Top)</td>
<td>W-6000-U</td>
</tr>
</tbody>
</table>
### Plumbing Piping and Specialties

#### Part 22 10 00

**Location**
- Other LT Duty Finishes (Textures NB Top)  W-6000
- Other XH Duty Finishes (Scoriated XH NB Top)  W-6000-X
- Exterior Areas (Scoriated XH Di Top)  W-6000-Z
- Vertical rough piping (exposed)  W-8560-E
- Concealed piping in walls  W-8560-E with W-8480 - Round stainless steel cover.

B. **Manufacturer**: Wade, Zurn, Josam, Smith, MI-FAB.

**Part 3 - Execution**

### 3.1 Domestic Cold and Hot Water Systems

A. **Description**: Provide as indicated on the Drawings and as required to comply with all applicable codes and regulations, complete system of piping, fittings, valves, auxiliaries and accessories as required to connect cold and hot water to all items requiring cold or hot water.

B. **Pipe and Fittings**:
1. **Above Grade**: Type L and drawn copper in accordance with ASTM B88 and Division 22 Section “Copper Pipe and Fittings for Plumbing” (maximum pressure of 60 psig). Exposed pipe and fittings at fixtures shall be chrome plated.

C. **Installation**:
1. All interior piping shall be run square and straight with the building.
2. Piping in finished areas shall be concealed within walls, chases, enclosures, etc.
3. Piping in exposed areas shall be run as high as possible within joists and beam spaces, or below the floor as indicated on the Drawings.
4. Piping shall follow approved paths as shown or indicated on the Drawings. Connect to existing lines where required or to equipment in an approved manner. Locate pipes, valves and equipment accessible for maintenance, minimum obstruction of passage and work spaces.
5. Install drain valves at all low points in piping system.
6. Provide unions at each screwed valve, unions, and at all points in the piping system where necessary to facilitate dismantling.

### 3.2 Building Sanitary Drainage System

A. **Description**: Furnish and install the entire building sanitary drainage system as indicated on the Drawings. System includes, but is not necessarily limited to, the following items: Waste and vent piping for all plumbing, fixtures requiring same and cleanouts.

B. **Material**:
1. Above ground piping as defined in Part 2 of this Section.
2. Cleanouts as defined in Part 2 of this Section.

C. **Installation**:
1. General runs of sanitary sewer are indicated on Drawings diagrammatically and every bend, offset, etc., is not necessarily indicated, all of which must be installed to properly drain all stacks, fixtures, vents, etc.
2. Run horizontal waste lines at a minimum slope of 1/4-inch per foot.
3. Connections between mains and laterals shall be made with wyes and 1/8 bends.
4. Changes in direction shall be with long radius ells except in stacks where sanitary tees and short radius 1/4 bends may be used in changes from horizontal to vertical.
5. Cleanouts shall be installed where required by code and as indicated on the Drawings and specified herein. They shall be accessibly located, set flush with finish surface or finish grade, and shall be same nominal pipe size as line served, but no larger than 4 inches. Stainless steel cover plates required for wall accessed cleanouts.
6. Provide cleanouts located in waterproof above grade floors with flashing flange and clamp device. Flash with 60 mil PVC membrane minimum 4-foot square.
7. Pitch vent lines to gravity drain to waste pipe.

3.3 COOLING COIL CONDENSATE DRAINAGE SYSTEM

A. Each above-the-ceiling cooling unit shall have its condensate collection pan piped to nearest sanitary drain riser.
B. Piping shall be trapped as indicated on Drawings and pitched 1/8-inch per foot minimum.
C. Pipe size to match drain pan connection.
D. Use Type L copper pipe and hangers where necessary as defined in this Section.
E. Insulation required for all condensate drain piping.

3.4 CLEANING, TESTING, CHLORINATION

A. As piping material is erected, the inside of all piping shall be thoroughly cleaned of foreign material. Flush and test piping before operation in accordance with Division 22 Section “Testing and Cleaning of Plumbing Systems.”
B. On completion of the domestic water piping systems, chlorinate the system using methods acceptable to and approved by Engineer. Furnish all chlorine and chlorinating equipment.
C. After system chlorination is complete, submit water Samples to the governing health department for testing. Take Samples as directed by Engineer, and provide Engineer with a letter from the governing health department indicating test results.

3.5 SCHEDULES

<table>
<thead>
<tr>
<th>System</th>
<th>Schedule</th>
<th>Material</th>
<th>Specifications</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>Above Ground</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sanitary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S.V.</td>
<td>C.I.</td>
<td>ASTM C564, A888</td>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Domestic Water Above Ground</th>
</tr>
</thead>
<tbody>
<tr>
<td>125 PSI Maximum Pressure</td>
</tr>
<tr>
<td>Pipe Size</td>
</tr>
<tr>
<td>1/4 – 6</td>
</tr>
</tbody>
</table>

END OF SECTION 22 10 00
SECTION 22 40 00 – PLUMBING FIXTURES

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 furnishing and installation of plumbing fixtures.

B. Division of Work:
   1. In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the work to be performed by specific trades.
   2. The following are suggestions as to how the Work may be divided. This is not a complete list of all the work:
      a. General Contractor: Install or arrange for installation of all fixture supports and carriers as directed by mechanical Subcontractor.
      b. Mechanical Subcontractor:
         1) Furnish all required fixture supports and carriers.
         2) Instruct General Contractor regarding location and installation of supports and carriers.
         3) Be responsible for proper rough-in locations and dimensions.
      c. Faucet Manufacturer: Provides remote transformers for barrier free special trim.
      d. Electrical Subcontractor: Installs transformers for barrier free special trim.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ANSI Standard:
      a. A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.
      b. A112.19.2 - Vitreous China Plumbing Fixtures.
      c. A112.19.3 - Stainless Steel Plumbing Fixtures.
      d. A112.19.5 - Trim for Water Closet Bowls, Tanks & Urinals.
   2. ARI - Air Conditioning and Refrigeration Institute - Standard: Drinking Fountains and Self-Contained, Mechanical Refrigerated Drinking Water Coolers.
   3. ADA - Americans with Disabilities Act.
   4. ASSE - American Society of Sanitary Engineers.

1.4 SUBMITTALS

A. Manufacturer's Literature: For fixtures.
   1. Model number/name.
   2. Manufacturer's name.
   3. Dimensions.

1.5 QUALITY ASSURANCE

A. Installing personnel shall be adequately trained and experienced in the installation of the materials and equipment.
B. Regulatory Requirements:
   2. Installation shall comply with Americans with Disability Act (ADA) regarding type of fixtures and trim, height and clearance requirements, and safety components and systems.
   3. Comply with the State of Michigan barrier free design requirements as published by the Michigan Department of Labor Construction Code Commission.

PART 2 - PRODUCTS

2.1 MANUFACTURER


B. Flush Valves: Sloan, Zum, Delaney.

C. ADA Drain and Water Line Safety Covers at Lavatories and Sinks:
   1. Handy shield safety covers, Plumberex Specialty Products, Cathedral City, CA.
   2. Handi Lav-Guard, Truebro, Inc., Ellington, CT.

D. Faucets: Bradley, Moen, Zum, Chicago Faucets, Delta.

E. Fixture Carriers: Wade, Josam, Zum, Smith.

2.2 GENERAL

A. Traps:
   1. Equip fixtures with traps (with cleanouts) unless indicated otherwise, of the same size as the fixture connection.
   2. P-traps (above grade): Cast brass, adjustable, with a cleanout plug and 17 gage tubing outlet, chrome plated.
   3. Size branch lines as indicated.

B. Assemblies:
   1. Where fixtures are described by a Manufacturer's assembly number, furnish the complete assembly.
   2. Additional items not ordinarily furnished in the assembly will be indicated or noted.

C. Where roughing-in or installing fixtures and equipment furnished by other trades, provide required stops, supplies and traps, as well as rough-in, installation, and connecting work.

D. Finishes:
   1. Vitreous China Fixtures: White, unless specifically noted otherwise.
   2. Stainless Steel Fixtures: 20 gage minimum, Type 302, nickel bearing stainless steel, unless otherwise noted.
   3. Trim, fittings, traps, etc., where exposed to view: Heavy chrome plated.

2.3 WATER CLOSETS, URINALS AND LAVATORIES

A. Refer to the schedules on the Drawings for specific applications and the basis of design selections.
B. Fixture Carriers:
1. Manufacturer: Wade, Zurn Josam, or Smith.
2. Requirements:
   a. Secure wall mounted lavatories into position by means of carriers specifically manufactured for the fixture installed.
   b. Carriers shall be of proper size to fit within the space allotted.
3. Supports: Provide adequate internal supports for wall mounting brackets.

C. Barrier Free Special Trim:
1. Lavatory faucet activates water flow only when the user’s hands enter infrared detection zone.
2. Faucet turns itself off after the hands are removed from detection zones.
3. Incoming water shall be tempered with thermostatic mixing valve.
4. Tempered water shall not exceed 105 degrees F.
5. Thermostatic mixing valve and solenoids shall be contained in recessed stainless steel No. 304, 18 gage cabinet, with 16 gage door and key.
6. Barrier free lavatories shall have water supply tempered with an A.S.S.E. 1016 device.
7. ADA approved drain and water safety covers are required on all exposed piping under barrier free lavatories.

2.4 SERVICE SINKS AND SINKS
A. Refer to schedules on the Drawings for specific applications and the basis of design selection.
B. If sink is ADA compliant or used for handwashing, incoming water shall be tempered with approved thermostatic mixing valve.

2.5 MISCELLANEOUS PLUMBING APPLIANCES
A. Refer to the schedules on the Drawings for specific applications and the basis of design selection.

PART 3 - EXECUTION
3.1 INSTALLATION
A. Install fixtures at proper heights in accordance with applicable codes and as indicated on the Drawings.
B. Point up around fixtures where they abut a wall or floor unless so directed by Engineer.
C. Securely fasten fixtures to the floor, wall, or counter. Fixtures shall be level and square.
D. Follow Manufacturer’s instructions for fixture installations, especially for grouting and calking.

3.2 INSPECTION
A. Inspect each fixture and unit for damage to finish.
B. Remove and replace cracked, dented units and units or items unable to be repaired or restored to a condition acceptable to Engineer.

3.3 CLEANING
A. Thoroughly clean by washing with soap and disinfectant solution on all plumbing fixtures.
B. Remove, clean, and reinstall aerators.

END OF SECTION 22 40 00
SECTION 23 01 00 – OPERATION AND MAINTENANCE OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Refer to individual Division 23 sections for additional equipment specific Operations and Maintenance Manual requirements.

1.2 SUMMARY

A. This Section includes preparing and furnishing an operating and maintenance manual for mechanical equipment.

1.3 DESCRIPTION

A. Compile an Operating and Maintenance Manual:

1. For all building mechanical systems and major equipment items.

2. Including, but not necessarily limited to:

   a. Installing company's name, address, telephone number and name of job supervisor.

   b. Maintenance and operating booklets (as supplied by the equipment Manufacturer) for each item or representative type item installed.

   c. Valve tag schedule.

   d. A complete set of Shop Drawings.

   e. Temperature control drawings.

   f. Equipment information forms for each equipment piece.

3. Each equipment information form include all applicable items of the following:

   a. Type of unit.

   b. Manufacturer's name.

   c. Equipment service area.

   d. Filter Information:

       1) Filter change period.

       2) Type of filter.

       3) Size of filter and number.

   e. Motor and Drive Information:

       1) Belt type and quantity.

       2) Belt size.

       3) HP.

       4) Voltage.

       5) Phase.

   f. Lubrication Information:

       1) Recommended service interval.

       2) Lubricant application points.

       3) Recommended lubricant type.

   g. Recommended cleaning procedures and intervals.

B. Prepare Information Packets:

1. Attach to each major piece of equipment in a string tie envelope labeled with the equipment's designation in large print.

2. Information Required:

   a. A copy of the equipment information form as defined above.

   b. A temperature control written operation sequence.

   c. A maintenance checklist form with equipment identification information and listing all relevant maintenance procedures in a column format to accommodate date entries.
1.4 SUBMITTALS

   A. Three copies of Operating and Maintenance Manual.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 23 01 00
SECTION 23 05 00 – GENERAL HVAC PROVISIONS

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 specifying the general requirements for execution of that portion of the Work defined in Division 23 of these Specifications and as indicated on the Drawings:

1. Major items include, but are not necessarily limited to:
   a. Cutting and patching.
   b. Concrete foundations and support steel.
   c. Piping, fittings and valves.
   d. Piping, ductwork and equipment insulation.
   e. Temperature and pressure gages.
   f. HVAC equipment, including drives.
   g. Ductwork.
   h. Temperature control systems.
   i. Demolition of existing mechanical work.
   j. Labor, materials, equipment, tools, supervision and start-up services.
   k. Mechanical systems testing, adjusting and balancing.
   l. Mechanical systems commissioning.
   m. Instructions to Owner regarding operation.
   n. Incidental and related items necessary to a complete and functionally operational installation of the Work.

B. Division of Work: In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the Work to be performed by specific trades. The following are suggestions as to how the Work may be divided. This is not a complete list of all the Work:

1. General Contractor:
   a. Install access doors.
   b. Provide concrete isolation and housekeeping pads for mechanical equipment.
   c. Refer to Division 01 Section “Cutting and Patching.”
   d. Provide access doors in walls and ceilings for access to mechanical equipment.

2. Mechanical Subcontractor:
   a. Refer to Division 01 Section “Cutting and Patching.”
   b. Furnish location, size and quantity of openings to Contractor before construction of new walls, ceilings, and floors.
   c. Furnish size and locations of concrete equipment isolation and housekeeping pads as required for this Work and as indicated on the Drawings to Contractor before slabs are poured.
   d. Furnish size and location of access doors required for this work as indicated on the Drawings to Contractor.
   e. Provide miscellaneous structural steel required in connection with support of the Work of Division 23.
   f. Perform final cleaning of mechanical systems and equipment.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of Division 23 shall comply with the following:

2. ASME - American Society of Mechanical Engineers:
   b. B31.9 - Building Services Piping.
c. Boiler and Pressure Vessel Code:
   1) Section I.
   2) Section II.
   3) Section IV.
   4) Section VIII.
4. International:
   b. Mechanical Code 2015 including state amendments.

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

A. Construction details, components, accessories, sizes and model numbers indicated on the Drawings or in
these specifications are used to indicate minimum levels of quality and coordination requirements.

B. Design and layout, including clearances and service access, are based on Manufacturer, model and
components as scheduled or otherwise indicated on the Drawings. Other listed approved Manufacturer's
components and equipment are acceptable provided the following conditions are satisfied:
1. Meet minimum requirements listed in specifications or on Drawings, be compatible with facility and
intended use, and meet requirements for a functional system.
2. Present to Engineer documentation verifying that all the above conditions are satisfied at least 10 days
prior to bid receipt date.
3. Meet all sound criteria as listed. Additional sound attenuation materials may be used if required.
4. Coordinate and pay for all changes resulting from the use of alternate equipment and components:
   a. Coordinate and pay for all resulting work in other trades, including redesign efforts.
   b. Make all duct and piping system changes required in utilizing alternate equipment. Changes must
      reflect building conditions, ceiling spaces, chase sizes, structure locations.
   c. Obtain Engineer's prior approval for all changes to layout, clearances, components and service
      access proposed.

C. Drawings:
1. Are diagrammatic and indicate general arrangement of systems and work included.
2. Do not necessarily indicate every required valve, fitting, trap, thermometer, gage, duct, elbow, transition,
ofset turning vane, mounting support and access panel.
3. Shall not be scaled for measurement or installation location.
4. Shall not serve as Shop Drawings.

D. Schedules and model numbers shall not be used to:
1. Serve as final, definitive quantity requirements. Contractor shall make own count as indicated on
   Drawings.
2. Determine proper type or model with arrangement, mounting and accessories applicable.

E. Coordinate installation work of Division 23 with work of other trades to provide a complete and functional
system. Generally, the location of ductwork, sanitary, storm and vent piping take precedence over fire
protection and HVAC piping, electrical conduit and cable trays.

1.5 SUBMITTALS

A. System Start-up Schedules:
1. Submit 2 weeks prior to earliest proposed date.
2. List time and date for the following for each system:
   a. Start-up.
   b. Demonstration.

B. Completion Reports:
1. Submit within 1 week after each system demonstration.
2. List time, date and persons present for the following for each system:
   a. Start-up.
   b. Demonstration.
3. Include Manufacturer's representative's report indicating:
   a. Approval of installation.
   b. Satisfactory start-up.
   c. Functioning correctly.
4. Indicate that demonstration and instructions were satisfactorily completed.

1.6 PRODUCT UNLOADING AND HANDLING

A. Unload equipment and materials required for completion of the Work.

B. Handle and store equipment and materials carefully to prevent damage. Method of rigging and handling shall be subject to the approval of an authorized representative of the equipment Manufacturer whose equipment is being handled.

1.7 TROUBLESHOOTING

A. By Contractor: If, during the start-up or warranty period, mechanical systems operational problems occur for which the root cause is not readily apparent, Contractor shall promptly, through a Subcontractor or other resource designated by Subcontractor, provide diagnostic and investigative services to determine the cause or causes.

B. By Engineer:
   1. At Contractor's request, Engineer will provide the services necessary to determine the cause or causes of the operational problems.
   2. Under the provisions of the General Conditions, Engineer will also provide these services if Contractor fails to respond satisfactorily to operational problems within a reasonable time after written notice from Engineer.
   3. If while working at Contractor's request or under the provisions of the General Conditions, Engineer determines that the problems are due to failure of the Work to comply with the requirements of the Contract Documents, Owner will compensate Engineer for additional services and deduct the amount paid from payment or payments to Contractor.

1.8 MAINTENANCE

A. Special Tools: Where special tools are required for operation, furnish these to Owner.

B. Loose and Detachable Parts:
   1. Retain loose and small detachable parts of the apparatus and equipment furnished until the completion of the Work.
   2. Turn over these parts to Owner.

C. Start-up Filters:
   1. Do not run air handling equipment without filters.
   2. Use of installed permanent heating and cooling equipment ductwork systems shall be in accordance with Division 01 Section "Temporary Facilities and Controls."
   3. Provide temporary filters as required to protect the air handling systems during construction phase work.
   4. Just prior to Substantial Completion, replace temporary construction filter elements with the specified filter systems.

D. Permanent Heating Equipment:
   1. Notify Engineer when installed and proposed to be used to heat building interior.
   2. Filters:
      a. In accordance with Division 23 Section "HVAC Air Cleaning Devices."
      b. Securely supported at each return and exhaust air open duct end and grille.
      c. Support filter length at required intervals to prevent filter deformation.
   3. Ductwork used by Contractor without adequate protection shall be cleaned to Architect's satisfaction.
E. Construction Strainers:
   1. Remove after flushing and cleaning and prior to commencement of TAB.
   2. Attach removed construction strainer to piping where removed as proof of removal.

PART 2 - PRODUCTS

2.1 FABRICATIONS

A. Miscellaneous Structural Steel:
   1. Structural steel work shall be done in accordance with the AISC Specification for Design, Fabrication and Erection of Structural Steel for Buildings, except that allowable stresses shall be reduced 25%.
   2. Where required, high strength structural steel bolting conforming to ASTM Specification A325 and assembled to AISC "Specifications for Assembly of Structural Joints. Using High Strength Steel Bolts" or welding shall be used in place of rivets.
   3. Connections shall be properly designed for the type of connection and the loads to be carried, and shall be subject to Engineer's or Owner's approval.
   4. Welding shall be done by operators who have been previously qualified by tests as prescribed in the American Welding Society "Standard Qualification Procedure" to perform the type of work required.
   6. Finished members shall be true to line and free from twist, bends and open joints.

B. Material installed in a ceiling plenum shall be either non-combustible or have a maximum flame spread of 25 and a maximum smoke developed rating of 50.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Character of Work: Installation shall be executed in a workmanlike manner and shall present a neat mechanical appearance when completed.

B. Laying Out of Work:
   1. Layout piping, ductwork, equipment and components in accordance with the Contract Documents and the Manufacturer's recommended practice, including provision of adequate space for maintenance. Review layout with Engineer prior to installation.
   2. Check drawings of other trades to verify spaces in which work will be installed. Maintain maximum head room and space conditions at all points. Where head room or space conditions appear inadequate, notify Engineer before proceeding with installation.
   3. If directed by Engineer, Contractor shall make reasonable modifications in the layout as required to permit proper execution of the Work and to prevent conflict with work of other trades.
   4. Work shall be installed so as to be ready for operation, maintenance and repair. Minor deviations from Drawings may be made to accomplish this. Changes shall not be made without approval of Engineer.
   5. Unless indicated otherwise, install piping and ductwork concealed above ceilings or within walls.

3.2 MODIFICATIONS TO EXISTING FACILITIES

A. Comply with the requirements of Division 02 Section “Selective Demolition,” for all work related to the modification, alteration, conversion, renovation, and reuse of existing facilities.

3.3 PIPE FITTINGS

A. Provide insulating couplings or unions where dissimilar materials are joined.

B. Provide unions at valves and at equipment for making repairs.
3.4 PAINTING

A. Paint exposed, non-insulated piping in accordance with the requirements of Division 09 – Finishes.


C. Valves, Fittings, and Supports:
   1. Paint valves and fittings the same base color as the pipe they adjoin.
   2. Paint floor stands the same base color as the pipe they adjoin.
   3. Paint wall brackets and pipe hangers the same base color as the wall or ceiling they adjoin, or gray, if wall or ceiling is not painted.

3.5 CODING AND TAGGING

A. Piping:
   1. Applied to new piping after installation, insulation, and final painting.
   2. Conform to Owner’s existing standards or conventions.
   3. Markings:
      a. Painted on, 1-inch high black letters.
      c. Directional arrow.
   4. Place markers at:
      a. 20-foot centers with at least 1 in each room.
      b. Near each valve and control device.
      c. Near locations where pipes pass through wall or floors/ceilings, or enter non-accessible enclosures.
      d. At access doors, manholes and similar access points which permit view of concealed piping.
      e. Near major equipment items and other points of origination and termination
      f. Every change in direction.
      g. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
      h. On piping above removable acoustical ceilings, except omit intermediately spaced markers.
   5. Plastic coated "Set Mark-Snap-Around" pipe markers manufactured by Seton Name Plate Corp., or Brady Co., may be used in lieu of painted markers and bands.

B. Valves:
   1. Brass Valve Tags: Provide 19-gauge polished brass valve tags with stamp engraved piping system abbreviation in 1/4-inch high letters and sequenced valve numbers 1/2-inch high, and with 5/32-inch hole for fastener.
      a. Provide 1-1/2-inch diameter tags, except as otherwise indicated.
      b. Provide size and shape as specified or scheduled for each piping system.
   2. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.
   3. Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures.
   4. Furnish schedule(s) of tagged valves with number, location (room or space utilizing WSU's official room numbering scheme), piping system abbreviation (as shown on tag) and purpose of each valve. Provide schedule typewritten and reproduced on 8-1/2-inch x 11-inch bond paper.
   5. Place a copy of each schedule:
      a. In the Maintenance Instructions.
      b. Mount on the wall in Mechanical Room at location directed by owner.
      c. For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.
C. Where valves, dampers, fans, and terminal units are located above the ceilings, a cadmium plated screw or such marking as designed by Engineer shall be located in the ceiling tile directly below the device.

D. Provide record documentation of all hydronic system air vent locations on record drawings (as-builts) or other method as approved by Engineer.

E. Equipment:
   1. Provide for:
      a. Each rooftop unit and terminal air unit.
      b. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
      c. Strainers, filters, and similar equipment.
      d. Meters, gauges and similar units.
      e. Labeled with its tag name/number as given on the Drawings.
      f. Use 2-inch high stenciled painted lettering.
   2. Similarly label control components associated with the above named equipment items.

F. Dampers:
   1. Provide for each fire damper, combination fire/smoke damper, smoke damper, and balancing damper.
   2. Label shall bear the tag name and number as indicated on the Drawings.
   3. Use 2-inch high stenciled black lettering.
   4. Mark balancing damper location after final adjustment.

3.6 START-UP
A. Comply with the requirements of Division 01 Section “Starting and Adjusting.”

3.7 ADJUSTING
A. Adjust and align equipment for smooth operation:
   1. Plumb true and with parts in proper position and alignment.
   2. Rotating parts shall turn freely and in the correct direction.
   3. Flexible couplings shall be checked for alignment subject to Owner’s approval.
   4. Follow Manufacturer’s instructions.

B. The work of installation shall be executed in conformity with the best practice, so as to contribute to efficiency of operation, minimum noise or vibration, minimum maintenance, accessibility and sightlines.

3.8 FIELD QUALITY CONTROL
A. Manufacturer’s Field Services:
   1. Provide when required by individual Section.
   2. Provide the following services except where indicated otherwise in individual Sections:
      a. Inspect, check and approve system installation.
      b. Supervise system start-up.
      c. Provide written report indicating that system:
         1) Has been properly installed and lubricated.
         2) Is in accurate alignment.
         3) Is free from undue stress imposed by connecting lines or anchor bolts.
         4) Has been satisfactorily operated under full load conditions.
      d. Demonstrate operation of system to Owner’s personnel.
      e. Instruct Owner’s personnel on operation and maintenance of system.
B. Performance Test:
   1. Test the entire Work, including all of its individual systems for 2 weeks before final payment will be made.
   2. Every phase of plumbing, air conditioning and heating and ventilating plant shall be operated separately, or in conjunction one with the other to demonstrate to Engineer the ability of the plant to meet capacity and performance requirements while maintaining design condition, in accordance with the true intent and purpose of these Specifications.
   3. Make final tests in the presence of Owner and Engineer.
   4. If a part of the Work or equipment does not meet Specifications:
      a. Correct the situation.
      b. Obtain approval of Engineer before final payment is made.
   5. Provide the personnel and bear costs for correcting malfunctions.
   6. Owner will provide operating personnel and utilities.
   7. Air systems balancing shall be completed prior to performance testing.

C. Comply with the requirements of Division 01 Section “Starting and Adjusting.”

3.9 CLEANING AND FINISHING

A. Comply with the requirements of Division 01 Section “Cleaning and Waste Management.”

B. Entire installation shall be free from surface oil and grease before work will be considered for final payment.

C. After tests have been made and the system pronounced tight:
   1. Clean piping and equipment.
   2. Lubricate bearings.

D. Final cleaning includes but is not limited to the following:
   1. Equipment with Factory Finishes:
      a. Wash factory-finished equipment with mild soap and water and leave in first-class condition, entirely free of stains or streaks.
      b. Do not use abrasive materials.
      c. Touch up scratches or other violations of the factory finish paint with matching paint from the equipment Manufacturer.

END OF SECTION 23 05 00
SECTION 23 05 03 – STEEL PIPE AND FITTINGS 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 the furnishing and installation of steel pipe and fittings.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:

1. ANSI Standards:
   b. B16.4 - Cast-Iron Threaded Fittings, Class 125 and 250.
   c. B16.5 - Pipe Flanges and Flanged Fittings, Steel Nickel Alloys and Other Special Alloys.
   e. B16.11 - Forged Steel Fittings, Socket Welding and Threaded.
   f. B16.21 - Nonmetallic Flat Gasket for Pipe Flanges.
   g. B18.2.1 - Square and Hex Bolts and Screws, Inch Series.
   h. B18.2.2 - Square and Hex Nuts.
   i. B31.1 - Power Piping.
   j. B31.9 - Building Services Piping.

2. American Society of Mechanical Engineers (ASME) publications:

3. ASTM Standards:
   a. A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
   b. A105 - Forgings, Carbon Steel, for Piping Components.
   c. A106 - Seamless Carbon Steel Pipe for High-Temperature Service.
   e. A181 - Forgings, Carbon Steel for General Purpose Piping.
   f. A182 - Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings and Valves for High Temperature Service.
   g. A193 - Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
   h. A194 - Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
   i. A197 - Cupola Malleable Iron.
   j. A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
   l. A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile.
   m. A312 - Seamless and Welded Austenitic Stainless Steel Pipe.

1.4 SUBMITTALS

A. Submit Manufacturer's Literature: For steel pipe and fittings. Include Manufacturer name, Manufacturer location, dimensions, and details of construction and installation.

B. Manufacturer's Literature: For couplings and gasketing material.
1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

B. Labeling: Piping materials shall bear the label, stamp or other marking of all specified standards and testing compliance.

C. Testing of Steel Piping: In accordance with Division 23 Section “Testing and Cleaning of HVAC Systems.”

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:
   1. Except as herein specified or as indicated on the Drawings, all materials shall be in accordance with the Piping Systems Schedule in Part 3 of the appropriate applicable specification section.
   2. Pipe 6’0” and longer shall be permanently marked with the following information:
      a. Manufacturer's name.
      b. Pressure rating.
      c. Size.
   3. Unless indicated otherwise in application sections of these specifications, all pipe joints shall be welded for pipe sizes 2-1/2 inches and larger.

B. Black Steel Pipe:
   1. Black steel pipe shall be welded or seamless carbon steel, as specified for the type of service.
   2. Welded black steel pipe shall meet the requirements of ASTM A53 or A106, and shall be Type F continuous-weld furnace butt-welding (CW), or Type E electric resistance welded (ERW) Grade B.
   3. Seamless black steel pipe shall meet the requirements of ASTM A53 or A106, Type S seamless, Grade A or B.

2.2 FITTINGS

A. Unions:
   1. Pipe Sizes 2 Inches and Smaller:
      a. Forged steel with ground joint.
      b. Properly fitted for design temperature and pressure.
      c. 2000 pound rated equal to Crane No. 250H or 251H.
      d. 3000 pound rated equal to Crane No. 252H.
   2. Pipe Sizes 2-1/2 Inches and Greater: Use companion flanges where unions are required.

B. Tapped Bosses:
   1. Permitted in pipes and fittings.
   2. 1-1/2-inch maximum hole size.
   3. Boss Construction:
      a. Weld material built up to a thickness 50% greater than required threads.
      b. Forged bosses as approved by Engineer.
      c. 300 pound rated half couplings welded to pipe permitted for instrument connections 3/4-inch or smaller.

C. Screwed Fittings:
   1. Class 300 iron in accordance with ANSI B16.4.
   2. Nodular or ductile iron in accordance with ASTM A395.
   3. Forged steel in accordance with ASTM A181.
   4. Schedule 80 fittings shall be used with Schedule 80 pipe.
D. Welding Fittings:
1. Meet ASTM A 234 symbol WPA or WPB.
2. The A or B grade shall conform to the grade of pipe used with the fittings.
3. Dimensional standards shall conform to ANSI B16.9.
4. Schedule 80 fittings shall be used with Schedule 80 pipe.

E. Flanges:
1. General:
   a. Welding neck or slip-on type with raised face.
   b. Conforming to ANSI B16.5.
   c. Class 150 and 300 conforming to ASTM A181, Grade I.
   d. Class 600 and 900 conforming to ASTM A105, Grade II.
2. Use threaded or socket weld type for piping smaller than 2-1/2 inches.
3. Use flat face steel flanges when matching cast iron companion flanges.

F. Flange Gaskets:
1. Nonasbestos compressed material conforming to ANSI B16.21 and suitable for 600 degrees F service.
2. Ring type, 1/16-inch thickness.
3. Spiral wound stainless steel for service over 300 psi.
4. Use full face gaskets with flat face flanges.

G. Bolting Material:
1. General:
   a. Carbon steel, square-head bolts and Grade 2H hex nuts.
   b. Bolt length shall be sufficient to extend completely through nut with maximum 3/8-inch projection.
   c. Dimensions conforming to ANSI B18.2 (bolts) and ASTM A194 (nuts).
2. Bolts:
   a. For service below 250 psig/450 degrees F, use Grade B conforming to ASTM A307.
   b. For service at or above 250 psig/450 degrees F, use Grade B7 conforming to ASTM A193.

H. Socket Welding Fittings: All forged steel socket-welding fittings shall conform to ANSI Standard B16.11 ASTM A105 Gr. II, equal to Crane 3,000-pound forged fittings.

PART 3 - EXECUTION

3.1 PREPARATION

A. During Freezing Weather:
1. Protect all materials in such a manner that no harm can be done to:
   a. Installations already made.
   b. Materials and equipment on the Site.
2. Furnish all necessary protection for such installations and equipment as may be required.

3.2 ERECTION

A. General:
1. All Piping: Follow approved paths as indicated on the Drawings.
2. Connect to existing lines where required, or to equipment in an approved manner.
3. Locate Pipes, Valves and Equipment to Provide:
   b. Minimum obstruction of passageways and working space.
4. Normally, all pipe runs shall be plumb, parallel with the building and level, except for drain slope.
5. Be responsible for establishing and maintaining drain slope of piping in order to ensure drainage.
6. Expansion of Piping:
   a. All pipe connections shall provide freedom of movement of the piping during expansion and contraction without springing of piping or injury to building steel or structure.
   b. Any damage to building steel or structure as a result of work installed by Contractor shall be repaired at Contractor's expense.
7. As Piping Material is Erected:
   a. Thoroughly clean the inside of all piping.
   b. Remove foreign material such as scale, sand, weld spatter, particles and cutting chips.

8. Provide caps or plugs in all openings at the end of each day's work and as otherwise directed for the protection of the piping. Particular attention must be given to avoid the possibility of any foreign material entering the pipes.

9. Flanges shall be made on pipe so that the gasket surface forms an angle of 90 degrees with the pipe axis. Screwed flanges shall be made on until the pipe projects through the flanges and then the flanges must be refaced.

B. Sleeves and Holes:
   1. Contractor shall be responsible for cutting required holes and openings in floors, walls and other structures, except as noted on the Drawings. Sleeves will be placed by Contractor in all such openings, and no holes shall be cut without Owner's approval. Sleeves shall be in accordance with the standard details included in the Drawings.
   2. All holes in floors, walls, roofs, etc., where pipe lines or other materials have been removed or installed, shall be neatly and properly filled with concrete, brick or other material in accordance with the general character of the construction at the location.

C. Unions and Eccentric Fittings:
   1. Unions shall be provided at each screwed valve and where their use will facilitate dismantling of the piping and as required or directed in special cases.
   2. Eccentric fittings or eccentric reducing couplings shall be provided in all cases where air or water pockets would otherwise occur in the main due to the reduction in pipe size.
   3. All reducing fittings used at pump inlets shall be eccentric, flush on bottom and flush on the top for hydronic piping.
   4. Eccentric fittings shall keep the pipes flush on the bottom for steam and condensate piping.

D. Pipe Joints:
   1. Pipe connections at all valves shall be mechanically joined unless otherwise indicated on the Drawings or reviewed by Owner or Engineer.
   2. Pipe joints which will be buried or otherwise concealed shall be welded regardless of size.
   3. Mitered joints shall not be permitted.
   4. In general, black steel 2-1/2-inch and larger shall be welded except that a flange or union shall be provided at all valves and at equipment.
   5. The connections to welded 2-1/2-inch and larger pipe shall be made with a welding tee or Weld-o-let of butt, socket or threaded type as required. Scarf welding of side connections shall not be permitted.
   6. Only welding ells shall be used for changing pipe directions of welded pipe lines.

3.3 WELDING

A. All Pipe Welding:
   1. Where welding is called for, it shall be of the fusion process and shall consist of welding by means of either the oxyacetylene or electric arc process.
   2. The pipe assembly at orifice and flow nozzle locations shall be left unassembled until inspected and approved by Owner or Engineer.
   3. All welding shall conform to the ASME Boiler and Pressure Vessel Code or the ANSI Code for Pressure Piping. All welders shall be qualified in accordance with ASME Standard Qualifications for Welding Procedures, Welders and Welding Operators, or Section 9 of the ASME Boiler and Pressure Vessel Code for the class of piping being welded. Submit welding qualifications for all welders on the Project when requested by Engineer.
   4. No welding to building work shall be allowed without approval of Engineer.
   5. Black steel piping may be welded with chill rings in lieu of that specified.
   6. Mitered turns will not be allowed. Turns shall be made with welded type fittings.
   7. Branch take-offs with manufactured formed nipples will be permitted, if not restricted by code, and where nipple size is at least two pipe sizes smaller than the main size. Formed nipples shall be Bonney Forge "Weldolets", "Threadolets", "Sockolets."
3.4 ADJUSTING AND CLEANING

A. Clean and test piping in accordance with Division 23 Section “Testing and Cleaning of HVAC Systems.”

END OF SECTION 23 05 03
SECTION 23 05 09 – COPPER PIPE AND FITTINGS 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 the furnishing and installation of copper pipe and fittings.

B. Division of Work: In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the work to be performed by specific trades. The following are suggestions as to how the Work may be divided. This is not a complete list of all the work:
   1. General Contractor: Coordinate work of this Section with other trades.
   2. Mechanical Subcontractor: All work of this Section except as listed under General Contractor.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASTM Specifications:
      a. B88 - Seamless Copper Water Tube.
      b. B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

1.4 SUBMITTALS

A. Manufacturer's literature: For piping, couplings, fittings, and gasketing materials. Include dimensions, details of construction and installation, name of Manufacturer, and model.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

B. Testing of Copper Piping: In accordance with Division 23 Section "Testing and Cleaning of HVAC Systems."

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration and contamination with foreign matter.

C. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace removed materials at no additional cost to Owner.
PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Seamless Copper Tubing:
   1. Factory coded and marked.
   2. Conform to the following schedule:
      a. Aboveground: ASTM B88, Type L hard drawn.
      b. Buried: ASTM B88, Type K soft temper.
      c. Refrigeration: ASTM B280, Type ACR, hard drawn.
   3. Pipe Markings:
      a. All piping longer than 2'-0" shall have a permanent marking in accordance with ASTM or ANSI specifications.
      b. This identification shall include the following:
         1) Manufacturer's name.
         2) Pipe pressure rating.
         3) Pipe size.

B. Solder type shall conform to the following schedule:
   1. Hydronic System Lines: 50% tin, bismuth, 50% lead.
   2. Drain Piping: 50% tin and 50% lead.
   3. Condensate Drain Piping: 50% tin and 50% lead.
   5. Refrigerant Suction Lines: Silver braze.

C. Fittings: General Service: Sweat type, wrought copper, long radius elbows.

PART 3 - EXECUTION

3.1 PREPARATION

A. During Freezing Weather:
   1. Protect all materials in such a manner that no harm can be done to:
      a. Installations already made.
      b. Materials and equipment on the Site.
   2. Furnish all necessary protection for such installations and equipment as may be required.

3.2 ERECTION

A. General:
   1. All Piping: Follow approved paths as indicated on the Drawings.
   2. Connect to existing lines where required, or to equipment in an approved manner.
   3. Locate Pipes, Valves and Equipment to Provide:
      b. Minimum obstruction of passageways and working space.
   4. Normally, all pipe runs shall be plumb, parallel with the building and level, except for drain slope.
   5. Be responsible for establishing and maintaining drain slope of piping in order to ensure drainage.
   6. Expansion of Piping:
      a. All pipe connections shall provide freedom of movement of the piping during expansion and contraction without springing of piping or injury to building steel or structure.
      b. Any damage to building steel or structure as a result of work installed by Contractor shall be repaired at Contractor's expense.
   7. As Piping Material is Erected:
      a. Thoroughly clean the inside of all piping.
      b. Remove foreign material such as scale, sand, weld spatter, particles and cutting chips.
   8. Provide caps or plugs in all openings at the end of each day's work and as otherwise directed for the protection of the piping.
B. Pipe Joints:
   1. Cut ends of copper tubing squarely using only sharp tube cutters.
   2. Ream pipe to full I.D. before preparing the joint.
   3. Soldering:
      a. Solder or braze joints by cleaning outside ends of all copper tubings and inside of fittings immediately before joining and soldering.
      b. Apply solder flux to both tube and fitting.
      c. Insert tube full depth into fitting, apply heat and solder in such a manner as to draw solder into and completely around the joint.
   4. Joining Valves:
      a. When joining copper lines to valves follow Manufacturer's instructions.
      b. In general:
         1) Valve shall be in the fully open position.
         2) Solenoid and expansion valves shall be broken down.

3.3 FIELD QUALITY CONTROL

A. Clean and test piping in accordance with Division 23 Section "Testing and Cleaning of HVAC Systems."

END OF SECTION 23 05 09
SECTION 23 05 13 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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 furnishing and installation of all electric motors required for Division 23 specified equipment.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. NEMA - National Electrical Manufacturers Association - Standards and publications governing the following performance criteria:
      a. Frame design.
      b. Torque.
      c. Enclosures.
      d. Dimensions.
      e. Power supply and voltages.
      f. Locked rotor KVA per horsepower.
      g. Service factor.
      h. Sound power levels.
   2. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. Manufacturer's Literature:
   1. All polyphase motors.
   2. All motors 3 horsepower (name plate) and larger.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacture of electric motors and their accessories, with minimum 3 years documented product development, testing, and manufacturing experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored onsite from weather and moisture by maintaining factory covers and suitable weatherproof covering.

B. For extended outdoor storage, remove motors from equipment and store separately in a protected area.

1.7 WARRANTY

A. Provide 2 year Manufacturer's warranty.
PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Reliance.
B. Magnetek.
C. Baldor.
D. Lincoln Electric.
E. Subject to compliance with specifications, motors drawing less than 250 watts and intended for intermittent service may be supplied by an alternate Manufacturer commonly used by the equipment Manufacturer.

2.2 SPEED (EXCEPT WHERE NOTED OTHERWISE)

A. 1,800 rpm.
B. Constant speed.

2.3 CONSTRUCTION

A. Designed for continuous operation in 40 degree C environment, Class B insulation. Motors interconnected with a variable frequency drive shall be provided with Class F insulation and shall be inverter duty rated, and shall be outfitted with [ shaft grounding kit or isolated bearings ] [ bearing protection ring ].

B. All copper windings with a minimum service factor of 1.15 for totally enclosed, fan-cooled (TEFC) and 1.25 for open, drip-proof (ODP) motors.

C. NEMA frame, arrangement, and design as required for the specific application.

D. Permanently lubricated unless specifically noted otherwise.

E. Comply with all requirements for UL approval and labeling for specific hazard classification where explosion-proof and severe duty motors are indicated.

F. Provide a visible stainless steel nameplate indicating:
   1. Motor horsepower.
   2. Voltage.
   3. Phase.
   5. RPM.
   6. Full load amps.
   7. Locked rotor amps.
   8. Frame size.
   9. Manufacturer’s name and model number.
   10. Service factor.
   12. Efficiency: Nameplate motor efficiency shall be identified in accordance with NEMA MG-1-12.54.2.

G. Except as specifically noted, all motors shall be high efficiency as listed in NEMA Standard 12.6 for all motors 1 horsepower and larger. All efficiency ratings are to be as tested in accordance with IEEE Spec. 112, Method B.

H. Electrical Connection: Conduit connection boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide screwed conduit connection in end frame.
I. Variable frequency drive units and motors shall be matched for proper operating characteristics.

2.4 VOLTAGE AND MOTOR TYPE

A. Special conditions and voltage are noted on the Drawings.

B. Single Phase Power - Split Phase Motors:
   1. Starting Torque: Less than 150% of full load torque.
   2. Starting Current: Up to 7 times full load current.
   3. Breakdown Torque: Approximately 200% of full load torque.

C. Single Phase Power - Permanent-Split Capacitor Motors:
   2. Starting Current: Up to 6 times full load current.
   3. Multiple Speed: Through tapped windings.

D. Single Phase Power - Capacitor Start Motors:
   1. Starting Torque: Three times full load torque.
   2. Starting Current: Less than 5 times full load current.
   3. Pull-Up Torque: Up to 350% of full load torque.
   4. Breakdown Torque: Approximately 250% of full load torque.
   5. Motors: Capacitor in series with starting winding; capacitor-start/capacitor-run motors shall have two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

E. 3-Phase Power - Squirrel Cage Motors:
   1. Starting Torque: One to one and one-half times full load torque.
   2. Starting Current: Six times full load current.
   3. Power output, locked rotor torque, breakdown or pullout torque: NEMA Design B characteristics.
   5. Insulation System: NEMA Class B or better.
   6. Motor Frames: NEMA standard T-frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
   7. Bearings:
      a. Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum AFBMA 9, L-10 life of 20,000 hours.
      b. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension.
      c. Stamp bearing sizes on nameplate.
   8. Sound Power Levels: To ANSI/NEMA MG 1, 75 dBA SPL at 3 feet maximum.
   9. Nominal Power Factor: Meet or exceed values in Schedules at full load and rated voltage when tested in accordance with ANSI/IEEE 112.

2.5 RATINGS

A. Motors shall meet NEMA standards and be capable of operating at rated load with a voltage variation of ±10%, a variable of ±5% in rated frequency, or a combined variation of 10% without damage to the motor.

B. Motors shall be selected for the type of service involved and shall be selected at a minimum of 15% above the required rating of the equipment served. (Does not include service factor.)

2.6 BELT DRIVES

A. Belt drive motors shall be provided with adjustable sheaves with the selected equipment speed occurring at the midpoint of the adjustable range. Install belt guards over drives in accordance with OSHA requirements.

2.7 THERMAL OVERLOADS

A. Provide built-in thermal overloads on all fractional horsepower motors.
PART 3 - EXECUTION

3.1 INSTALLATION

A. All materials and equipment shall be installed in accordance with Manufacturer's recommended installation methods for obtaining conformance with the Contract Documents.

B. Alignment of all motors, factory coupled or mounted, and all motors field coupled and mounted, shall be rechecked after all connections have been made and after 48 hours of operation in designed service.

C. Verify the voltage characteristics of each motor prior to ordering.

D. Verify the correct wire connections and rotation of equipment by "bumping" motor after wiring.

E. Confirm voltage imbalance on 3-phase motors is less than 2%.

3.2 APPLICATION: Except as specifically indicated, motors shall be selected as follows:

A. Shaded pole motors are not acceptable.

B. Phase, except where noted otherwise:
   1. 1/2 HP and Less: Single-phase.
   2. Larger than 1/2 HP: Three-phase.

C. Single Phase Starting:
   1. 1/8 HP and Less: Split phase or permanent split capacitor.
   2. Greater than 1/8 HP: Capacitor start.

D. Enclosure:
   1. Totally enclosed fan-cooled (TEFC) for all motors located outside, in wet areas, in mechanical rooms, or elsewhere as indicated.
   2. Open drip-proof (ODP) for motors located elsewhere, in a clean, dry environment.

END OF SECTION 23 05 13
SECTION 23 05 19 – METERS AND GAGES FOR HVAC PIPING

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 furnishing and installation of all temperature and pressure gages. Unless otherwise specified, gages shall be as described in this Specification.

1.3 REFERENCES
   A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
      1. ASME Standard:
         b. B40.30 - 1990 - Thermometers.

1.4 SUBMITTALS
   A. Manufacturer's Literature: For all gages and thermometers. Include name of Manufacturer, model, dimensions, and scale range.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. Ashcroft.
   B. H.O. Trerice.
   C. Weksler.
   D. MilJOCO.

2.2 EQUIPMENT
   A. Dial Thermometer:
      1. Bimetal type with adjustable dial face.
      2. Stainless steel case.
      3. 5-inch diameter dial.
      4. 6-inch nominal stem length, stainless steel.
      5. Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.
      7. Union lock nut.
      10. Scale range: Temperature ranges for services listed as follows:
           a. Hot Water: 30 to 300 deg with 2-degree scale divisions (0 to 150 deg C with 1-degree scale divisions).
           b. Chilled Water: 0 to 100 deg F with 2-degree scale divisions (minus 18 to 38 deg C with 1-degree scale divisions).
c. Steam and Condensate: 50 to 400 deg F with 2-degree scale divisions (10 to 205 deg C with 1-degree scale divisions).

11. Equal to H.O. Trerice B85600 Series.

B. Pressure Gage:
1. Bourdon tube type with direct coupled pointer, liquid filled.
2. 4-1/2-inch minimum diameter.
3. Accuracy of +1% of scale range.
4. Equal to H.O. Trerice 450 Series.
5. Liquid fill must be compatible with temperatures in measured fluid.
6. Case: Drawn steel or brass, glass lens, 4-1/2-inches diameter.
7. Connector: Brass, 1/4-inch NPS.
8. Scale: White coated aluminum, with permanently etched markings.
9. Range all fluids: 2 times operating pressure.

2.3 ACCESSORIES

A. Thermowell:
1. Provide for all thermometers.
2. 304 stainless steel.
3. Pressure rated to match piping system design pressure.
4. 2-inch extension for insulated piping and threaded cap nut with chain permanently fastened to well and cap.
5. Equal to H.O. Trerice Cat. No. 138-0015.3 (138.0016.2 for pipe 6 inches and over).

B. Coil Siphon:
1. Provide for all steam system installations.
2. Brass.
3. Equal to H.O. Trerice Series 885.

C. Needle Valve:
1. Provide for all pressure gages.
2. Equal to H.O. Trerice Series 735.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all thermometers and pressure gages in conformance with:
1. The Drawings.
2. These Specifications.
3. Manufacturer's recommendations.

B. Support all pressure gages and remote-reading thermometers:
1. With 12-gage formed steel bracket.
2. Secured to structure or equipment.

3.2 APPLICATION

A. Select all dial ranges such that normal operating temperature/pressure measured at point of installation is near mid-range.

3.3 ADJUSTING AND CLEANING

A. Adjusting: Adjust faces of meters and gages to proper angle for best visibility.
B. Cleaning: Clean windows of meters and gages and factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touch-up paint.

END OF SECTION 23 05 19
SECTION 23 05 23 – GENERAL DUTY VALVES 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 the furnishing and installation of all valves.

1.3 REFERENCES

A. Except as specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. General: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features as determined by Installer for installation requirements. Comply with ASME B31.9 for building services piping, and ASME B31.1 for power piping.
   5. Flangeless: Valve bodies manufactured to fit between flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

A. General:
   1. This Section is provided as a guide in the application and specification of specific valves intended for use in this Project. This Section does not instruct where to install these valves unless specifically noted. Refer to other specific Mechanical Specification Sections and Drawing details for instruction for location and use.
   2. As indicated on the Drawings.
   3. As called out in the Piping Systems Schedules.

B. Valves not specifically indicated on the Drawings:
   1. Size and class of valve and pipe schedule to agree with line in which installed.
   2. All valves 2-1/2-inch and larger shall be flanged unless noted otherwise.

C. Valves shall have Manufacturer's name, trademark and working pressure rating cast into the valve body.

1.5 SUBMITTALS

A. Shop Drawings for all valves.

B. Manufacturer's Literature: For All Valves:
   1. Manufacturer's name.
   2. Details of construction.
   3. Performance characteristics.
   4. Pressure and temperature ratings.
   5. Close-off pressure.
1.6 QUALITY ASSURANCE

A. Made in USA:
1. Unless specifically noted otherwise, all valves shall comply with the Federal Trade Commission Made in USA standard.
2. Supplier shall furnish documentation of USA content if requested by Engineer.

B. Fabrication and Installation Personnel Qualifications:
1. Trained and experienced in the fabrication and installation of the material and equipment.
2. Knowledgeable of the design and the reviewed Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Valves shall be manufactured by one Manufacturer for each type of valve. Where valve Manufacturers are not specifically indicated, they shall be one of the following:
1. Gate, Ball, Globe, Standard Butterfly, and Check Valves:
   a. Nibco.
   b. Kennedy.
   c. Crane.
   d. Milwaukee.
   e. Keystone.
   f. Stockham.
   g. Bonney Forge.
   h. Mueller Steam Specialties.
   i. Neles-Jamesbury.
   j. DeZurik.
   k. Apollo.
   l. Vogt.
   m. Walworth.
   n. Powell.
2. High Performance Butterfly Valves (2HBF2F):
   a. EBRO Armaturen.
   b. Metso/Jamesbury.
   c. Dezurick.
3. Control Valves – Globe Valves (Steam Service):
   a. Fisher.
   b. Leslie.
   c. Spence.
   d. Johnson.
   e. Seimens.
4. Control Valves (Hydronic Service):
   a. Armstrong.
   b. B&G.
   c. Nexus.

2.2 GENERAL

A. Materials - Bronze Valves:
1. All brass alloys used in valves shall contain no more than 15% zinc.
2. Alloys must comply with ASTM B61, B62 or B584.

B. Additional Materials: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features as determined by the Manufacturer for installation requirements.
1. Provide extended stem handles and necks with a minimum clearance of 1-1/2-inch on insulated service.
2. All valves used for throttling/balancing shall have adjustable memory stops.
3. Pressure ratings are at service indicated by application as specified according to the individual valve specifications.
4. Sizes: Same size as upstream pipe, unless otherwise indicated.
5. Neck extensions and right angle drives where indicated and where required for access to the operator.

C. Operators: Provide the following special operator features:
   1. Handwheels, fastened to valve stem, for valves other than quarter turn.
   2. Lever handles, on quarter-turn valves 3-inch and smaller, except for plug valves. Provide plug valves with square heads. For valves greater than 3-inch, provide gear operator with handwheel.
   3. Provide bevel gear operators with chain-wheels for all valves installed 6 feet or higher above finished floor. Extend chains to an elevation of 5 feet above finished floor.
   4. Provide rotary manual actuators with high ratio (80 to 1 minimum), disc positions and open and closed position stops on all butterfly valves. Actuators shall be designed for valve installation with the stem in a horizontal orientation to prevent debris from accumulating in the bearings.
   5. Automatic Operators: Provide in accordance with Division 23 Section “Instrumentation and Control for HVAC.”

D. Bypass and Drain Connections: Provide valved bypass where indicated on the Drawings. Comply with MSS SP-45 bypass and drain connections.

E. Valve Identification Systems Description:
   1. A system has been established which identifies the specific valves for each piping system as indicated on the Drawings. The specific valve specification is linked by the service number as depicted in the "Valve Index" listed in this Section.
   2. Valves may be identified on the Drawings by symbol. Size is indicated by the upstream size.
   3. Valves are specified in this Section according to the "Valve Index". In general, the following is a description of the format:
      a. The first symbol, consisting of one or more numerals, indicates the valve group pressure and temperature specification that applies to this valve.
      b. The second symbol, consisting of one or more letters, indicates the type of valve in accordance with the following listing:
         1) GB = Globe Valve.
         2) TBF = Triple Offset Butterfly Valve.
         3) HBF = High Performance Butterfly Valve.
         4) BF = Standard Butterfly Valve.
         5) BL = Ball Valve.
         6) CK = Check Valve.
         7) SCK = Silent Check Valve.
         8) GT = Gate Valve.
      c. The third symbol consists a numeral which indicates the size group.
      d. The fourth symbol, consisting of a letter, indicates the type of connection to the valve as follows:
         1) F = Flanged Ends.
         2) S = Screwed Ends.
         3) W = Weld Ends, Butt, or Socket.
      e. For example: For a 10-inch CHW shutoff valve, refer to 1BF2F which indicates a valve of Valve Group 1, Butterfly Type, and with flanged ends.
   4. There may be some instances where it is desirable to substitute an item, such as a valve or gasket at a particular location, in place of the one specified in the Index. In that event, the item will be clearly indicated and specified on the Drawings, and such an indication is to take precedence over the item specified in the valve group specifications. All other terms of that group specification are to be observed.

2.3 VALVE GROUP 1

A. Ball Valves:
   1. Symbol: 1BL1S - 2 Inches and Smaller:
      a. Ball valves used in connection with piping 2 inches in size and smaller shall have screwed or sweat ends, 2 piece bronze body, standard port with stainless steel ball and a like stem. VA rated for 150 pound SWP and 600 WOG. Seats and seals shall be reinforced virgin teflon for standard duty cycle.
**General Duty Valves for HVAC**

**Section 23 05 23**

**Wayne State University**
**Prentis Building Computer Lab Relocation**
**WSU Project Number 022-313456**
**FTCH Project Number 180746**

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**B. Standard Duty Butterfly Valves:**

1. **Symbol: 1BF2F – 2-1/2 Inches and Larger:**
   a. Iron body rated for 175 psig and 250 degrees F, bubble-tight shutoff.
   b. Lug body for use with ANSI flanges. Wafer style is not acceptable, except where specifically approved.
   c. Stainless steel disk, 416 stainless steel shaft, EPDM seat.
   d. Provide neck extended 2 inches beyond flange diameter.
   e. Bevel gear operator.

**C. Plug Valves:**

1. Plug valves shall be nonlubricated eccentric plug type rated for 175 CWP with semi-steel body neoprene coated plug and epoxy coated seat; equal to DeZurik PEC or Homestead Series 300. Furnish with compatible wrench. All valves used for throttling/balancing to have adjustable memory stop.

2. Plug valves (gas cock) for natural gas shutoff applications shall be lubricated type equal to Homestead Figure 611 or 612 or Rockwell Figure 114 or 115.

**D. Check Valves:**

1. **Symbol: 1CK1S - 2 Inches and Smaller:**
   a. Class 150 horizontal swing check valve, cast bronze body and cover, screwed ends, bronze seat and disc, screwed cover, integral seat, body and cover material to conform to ASTM B61 or B62.
   b. Provide valves capable of being reground while the valve remains in the line.
   c. Provide Class 150 valves meeting the above specifications, with threaded end connections, where system pressure requires or where Class 125 valves are not available.
   d. The valve shall conform to MSS SP-80.

2. **Symbol: 1CK2F - 2-1/2 Inches and Larger:**
   a. MSS SP-71; Class 125 cast iron body and bolted cap conforming to ASTM A126, Class B.
   b. Horizontal swing, and bronze disc or cast-iron disc with bronze disc ring; and flanged ends.
   c. Face to face dimension shall conform to ANSI B16.10. Flange shall be faced and drilled to ANSI B16.5.
   d. Working pressure and temperature ratings shall comply with ANSI B16.34 (Standard Class).

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**2.4 VALVE GROUP 2**

**A. Ball Valves:**

1. **Symbol: 2BL1W - 2 Inches and Smaller:**
   a. Rated for steam service at 150 psig, 500 degrees F conditions; 2 piece construction, with carbon steel body, regular port, 316 stainless steel ball and stem, replaceable seats and seals rated for temperature, blowout proof stem, vinyl covered steel handle, socket weld ends and extended stem for insulated piping.

**B. High Performance Butterfly Valves:**

1. **Symbol: 2HBF2F - 2-1/2 inches and larger:**
   a. Butterfly valves for steam condensate systems, 2-1/2 inches in size and larger, shall be high performance flanged, ANSI Class 150, suitable for continuous duty in 150 psig steam at 500 degrees F, carbon steel body, stainless steel shaft, stainless steel disc, RTFE seat with titanium/stainless steel ring, and fully bi-directional on dead-end service, double flanged body construction.
   b. Provide rotary manual actuators as specified above.
   c. In accordance with ANSI B16.5, 31.34 Construction for Body Components B31.1, 31.3 ASME Section VII, IX.
   d. Disc movement relative to shaft rotation shall be double offset design.
   e. Stem holding to clear required installation thickness.
   f. Have open position memory stop.
   g. Manually operated butterfly valves 4" and larger shall have enclosed worm gear operators with position indicator.
2.5 AUTOMATIC CONTROL VALVES

A. General:
   1. Comply with valve construction and trim as described in these specifications above for operating and rated pressure and temperature service group, with trim suitable for control duty as noted below. Refer to Part 3 of these specifications.
      a. Operating Pressure: Provide valve and operator designed for tight shutoff at 125% of design pressure:
         1) System Design Pressures:
            a) Steam: 15 psig (5 psig actual operating).
            b) Cooling Tower Bypass: 50 psig
      2. Sizing: 3 psi maximum pressure drop at design flow where Cv is not indicated for hydronic applications, 40% of supply pressure for steam applications.

B. Hydronic Control Valves:
   1. Where globe valves are indicated, provide straight through globe type, single seat for modulating device with equal percentage relationship between valve lift and fluid flow unless noted otherwise.
      a. Trim:
         1) Stem: Stainless steel.
         2) Plug: Stainless steel.
         3) Seat: Stainless steel, metal-to-metal.
         4) Cage: Stainless steel, replaceable.
   2. Where characterized ball valves are indicated or allowed, provide characterized port ball valve for modulating device with equal percentage relationship between valve lift and fluid flow unless noted otherwise.
   3. Provide globe, ball, or butterfly valve for two-position service.

C. Steam Control Valves:
   1. Provide straight through globe type, single seat for modulating device and two-position with linear relationship between valve lift and fluid flow unless noted otherwise.
   2. Trim:
      b. Plug: Stainless steel.
      d. Cage: Stainless steel, replaceable.
   4. Noise Attenuation: Valve noise level shall be no greater than 75 DBA, provide muffling orifice plate, acoustical insulation cover, and muffler as required.

2.6 FLANGE CONNECTIONS

A. Flange Gaskets: Refer to Division 23 Section “Hydronic Piping” for requirements for flange gaskets used on steam and hydronic valves.

B. Flange Bolts: Refer to Division 23 Section “Hydronic Piping” for requirements for flange bolts used on steam and hydronic valves.

2.7 DRAIN VALVES

A. Furnish at each low point 3/4-inch gate or ball valves as specified above.

B. Install nipple with cap at valve outlet.
PART 3 - EXECUTION

3.1 VALVE SCHEDULE

A. Unless otherwise noted on drawings or in specific application sections of this specification, the valve groups described in Part 2 of this specification shall be applied for each service type as follows:

1. Valve Group 1:
   a. Hydronic (chilled, condensing, and heating water) supply and return not exceeding 125 psig or 250 degrees F.
   b. Saturated steam less than 15 psig.
   c. Steam condensate not exceeding 15 psig and 250 degrees F after the trap.

2. Valve Group 2:
   a. Steam up to 125 psig and 500 degrees F.
   b. Steam condensate from steam service up to 125 psig and 500 degrees F prior to the trap.
   c. Pumped steam condensate not exceeding 125 psig and 250 degrees F.

3.2 INSTALLATION

A. Install valves in conformance with:
   1. The Shop Drawings reviewed by Engineer.
   2. The Manufacturer’s recommendations.

B. Install Valves:
   1. At all branch piping connection to mains.
   2. At all connections to equipment.
   3. As required for complete control or isolation of any piece of equipment or service to branch lines.
   4. In accessible locations.
   5. Equal in flow area to connecting piping, unless otherwise indicated.

C. No valve shall be installed with its stem below the horizontal.

D. Furnish chain operated hand wheels, including rust-proof chain and chain guide for inaccessible overhead valves.

E. Install flanged valves at equipment in a manner which allows equipment side of valve to be opened up without draining piping system.

END OF SECTION 23 05 23
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 furnishing and installation of all pipe hanging and support systems.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASME - American Society of Mechanical Engineers:
      b. B31.9 - Building Services Piping.
   2. MSS - Manufacturers Standardization Society:
      b. SP-69 - Pipe Hangers and Supports - Selection and Application - 1996.
      c. SP-90 - Guidelines on Terminology for Pipe Hangers and Supports.

1.4 DEFINITIONS

A. Pipe Restraint: Pipe supporting element which is designed to limit or direct pipe movement due to internal static pressure, gravitational forces, frictional forces from hangers, rollers, and guides, and forces from expansion compensation devices:
   1. Pipe restraints are not designed to restrain pipe movement caused by thermal expansion, shock or surge.

B. Pipe Guide: A pipe restraint designed to direct pipe movement along a single axis.

C. Pipe Anchor: A pipe restraint designed to provide a static point about which pipe movement normally occurs, by limiting the longitudinal and axial movement at that point.

D. Other Terms: As defined in MSS SP-90.

1.5 DESIGN AND PERFORMANCE REQUIREMENTS

A. Unless otherwise indicated on Drawings or in these Specifications, this Contractor shall be responsible to design and provide all pipe hangers, supports, restraints, braces, framing, etc., as required to comply with all applicable building codes, ASME B31 and MSS SP-69.

B. Comply with the requirements of Division 23 Section "Sound and Vibration Control for HVAC" for vibration isolation of piping.

C. Comply with the requirements of ASME B31.8 for pipe hangers and support of natural gas piping systems.

1.6 SUBMITTALS

A. Manufacturer's Literature: For structural steel attachment devices, hangers and rollers. Include name of Manufacturer; model number and MSS Type, if applicable; and piping systems to be used with.
B. Submit Shop Drawings for all engineered hanger, restraints and support assemblies.
   1. For Metal Framing Pipe Supports: Include locations, dimensions, lengths, Manufacturer, material, cross-section number or type, finish, pipe sizes, and pipe locations.

C. Upon request by Engineer, submit calculations for all engineered hanger, restraints and support assemblies.
   1. Calculations: For metal framing pipe supports upon request by Engineer. Include support locations, pipe sizes, pipe weights, allowable stresses, and actual stresses.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The materials of all pipe hanging and supporting elements shall be in accordance with the latest requirements of the ASME Code for Pressure Piping B31.1 and MSS Standard Practice MSS SP-58 and MSS SP-69 except as supplemented or modified by the requirements of these Specifications.

B. The material in contact with the pipe shall be compatible with the piping material so that neither shall have a deteriorating action on the other.

C. Special Finishes and Materials:
   1. All ferrous hangers and supports used in the following areas shall be hot dip galvanized unless noted otherwise:
      a. Outside.
      b. In wet or potentially wet areas.
      c. All areas where installed for piping and equipment that will not have field-applied coatings.

   2. Pipe attachments shall have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing, or shall be copper plated to achieve similar metal contact.

   3. Thermal Hanger Shield Inserts: 100-psi average compressive strength, waterproofed calcium silicate, encased with a sheet metal shield. Insert and shield shall cover entire circumference of the pipe and shall be of length indicated by manufacturer for pipe size and thickness of insulation.

2.2 MANUFACTURERS

A. Elcon.

B. Michigan Hanger.

C. Anvil.

D. Bergen.

E. Hilti.

F. Lindapter.

G. Thybar

H. Pate

I. Mirro

J. Roof Products and Systems

K. A.E.S.

L. MicroMetl.
2.3 PIPE HANGERS AND SUPPORTS

A. Horizontal Piping Hangers: Unless otherwise indicated and except as specified in piping system Specification sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).
2. Yoke Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 degrees F (49 to 232 degrees C) pipes, NPS 4 to NPS 16 (DN100 to DN400), requiring up to 4 inches (100 mm) of insulation.
3. Carbon or Alloy Steel, Double Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN20 to DN600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN15 to DN600), if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN15 to DN100), 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 (DN20 to DN200).
7. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).
9. Adjustable Swivel Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN15 to DN50).
10. Split Pipe Ring With or Without Tumbuckle Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN10 to DN200).
11. Extension Hinged or 2 Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN10 to DN80).
12. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30 (DN25 to DN750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

B. Supports and Rollers:

1. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast iron floor flange.
2. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast iron floor flange with U-bolt to retain pipe.
3. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion type support for pipes, NPS 2-1/2 to NPS 36 (DN65 to DN900), if vertical adjustment is required, with steel pipe base stanchion support and cast iron floor flange.
4. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN25 to DN750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.
5. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN65 to DN500), from single rod if horizontal movement caused by expansion and contraction might occur.
6. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN50 to DN1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
7. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN50 to DN600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
8. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN50 to DN750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

C. Vertical Piping Clamps: Unless otherwise indicated and except as specified in piping system specification 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 (DN20 to DN500).
2. Carbon or Alloy Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500), if longer ends are required for riser clamps.
D. Hanger Rod Attachments: Unless otherwise indicated and except as specified in piping system specification sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 degree F (49 to 232 degree C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type II, 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 degree F (49 to 232 degree C) piping installations.

E. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification 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 (32 mm).
3. Spring Cushion Roll Hangers (MSS Type 49): For equipping Type 42 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% 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% 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% 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 1 trapeze member.

2.4 HANGER RODS

A. Minimum rod diameters for rigid rod hangers shall be as shown in MSS SP-69 Table 4 (Minimum Rod Diameter for Single Rigid Rod Hangers) and as indicated in Part 3 of these Specifications.

B. Hanger rods shall be subject to tensile loading only. At hanger locations where lateral or axial movement is anticipated, suitable linkage shall be provided to permit swing.

C. Rod material must be compatible with hanger and comply with above. Do not field cut thread on galvanized rod.

D. Do not use perforated strap.

E. Multiple Supports:
   1. Horizontal banks of pipe may be supported on a common base member without regard to the pipe centerline elevation.
   2. In the supporting of multiple pipe runs, provisions shall be made to keep the lines in their relative lateral positions, using clamps or clips as required. Lines subject to thermal expansion shall be free to roll axially or slide.

2.5 SADDLES AND SHIELDS

A. All Piping:
   1. Saddle: MSS Type 39 Anvil Figure 160 -to 165.
   2. The saddles shall be tack welded in place and filled with insulation equal to that of the adjacent piping.
   3. Shield: MSS Type 40 (Anvil Figure 167), provide and install in accordance with Manufacturer's shield size selection tables.
   4. The contour of the saddle shall match the radius of the pipe insulation.
5. Thermal Hanger Shield Inserts: 100-psi average compressive strength, waterproofed calcium silicate, encased with a sheet metal shield. Insert and shield shall cover entire circumference of the pipe and shall be of length indicated by manufacturer for pipe size and thickness of insulation.

2.6 FABRICATED STEEL SUPPORTS AND RESTRAINTS

A. Provide as required:
   1. Steel shapes and plates.
   2. Bolts.
   3. Welds.

B. Materials and fabrication in accordance with:
   2. AISC Code of Standard Practice for Steel Buildings and Bridges (except Section 4.2.1.).

C. Design: Responsibility of Subcontractor.

D. Paint all finished fabrications: As specified in Division 09 Section “Painting.” Color as directed by Owner.

2.7 MANUFACTURED PIPE SUPPORT SYSTEM

A. Acceptable Manufacturers:
   1. B-Line.
   2. Elcen.
   3. Super Strut, Inc.

B. Provide products from one Manufacturer.

C. Components shall have galvanized coatings where installed for piping and equipment that will not have factory or field-applied finish.

D. Channel (Standard Applications):
   1. Mild strip steel.
   2. 12 gage minimum material.
   3. Factory painted equal to Unistrut Perma-Green.
   4. Equal to Unistrut Part No. P1000.

E. Clamps and Supports:
   1. Beam clamp equal to Unistrut Part No. P2785.
   2. Pipe strap equal to Unistrut Part No. P2558.
   3. Pipe roller equal to Unistrut Part No. P2474.
   4. All items fabricated in material equal to channel specifications.

F. Clamp Nuts:
   1. Mild bar steel for standard applications.
   2. Class 2 American Standard threads.
   3. Equal to Unistrut Part No. P1012.

2.8 BUILDING ATTACHMENTS

A. As indicated on the Drawings or in the Specifications.

B. Concrete Attachments:
   1. Provide galvanized finish for all attachments.
   2. Poured Concrete:
      a. Use cast-in-place inserts or bolted surface mounted attachments, at Contractor’s option.
      b. Expansion style anchors are not permitted on piping systems subject to vibration.
3. Precast Concrete Tees:
   a. Use fittings specifically designed for attachment to stems of precast tees.
   b. Drilling is not permitted except where specifically approved by Engineer and coordinated with precast Manufacturer to miss embedded, prestressed steel strands.

4. Precast Concrete Plank:
   a. Use toggle bolt attachment as indicated on Drawings.
   b. Alternatively, provide adhesive anchor, Hilti HY-20; or as approved.
   c. Drilling is not permitted except where specifically approved by Engineer and coordinated with precast Manufacturer to miss embedded, prestressed steel strands.

C. Horizontal Piping:
   1. Steel W, I, or S shapes: MSS Type 23 clamp with retaining clip, (Anvil Fig. 88 and Fig. 89) up to 2-inch; MSS Type 28 (Anvil Fig. 292) or MSS Type 21 (Anvil Fig. 133, 134) above 2-inch.
   2. Steel Channel: MSS Type 20 universal channel clamp.
   3. Bar Joists: Steel washer plate (Anvil Fig. 60).
   4. Concrete: See "B" above.
   5. Timber: Angle bracket and lag screws or as detailed on Drawings.
   6. Steel Z Shapes: Custom attachment required.

D. Vertical Piping:
   1. Steel Shapes: Welded brackets as approved by Engineer.
   2. Concrete: See "B" above.
   3. Timber: Ceiling hanger flange (Anvil Fig. 128R, 153) angle brackets and lag screws, or as indicated on Drawings.

E. In the absence of a Specification for a particular type of attachment, furnish attachments comparable in type and quality to that specified above for a similar situation.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. General Requirements:
   1. The selection of hangers and supports shall be based on the overall design concept of the system and any special requirements which may be called for in these Specifications or as indicated on the Drawings. The support systems shall provide for, and control, the free or intended movement of the system including its movement in relation to that of the connected equipment. They shall prevent excess stress resulting from the transfer of weight being introduced into the system or connected equipment.
   2. The selection of hangers and supports shall be made to provide the system with the degree of control that its operating characteristics require. Design hangers and supports to prevent sway and intended movement.
   3. The selection of hangers or supports will take into consideration the combined weight of the supported systems, including system contents.
   4. Select and install hangers and supports to allow controlled thermal and seismic movement of system, to permit freedom of movement between anchors, and facilitate action of expansion joints, expansion loops, expansion bends and similar units.
   5. The spans in MSS SP-69 Table 3 do not apply where concentrated weights, such as valves or heavy fittings, or where changes in direction of the piping occur between hangers.
   6. Select all hangers and supports rated for the maximum potential loading with pipe full.
   7. Select hangers for cold (less than 50 degrees F) piping service for installation over the insulation.
   8. Where significant, vertical movement of pipe occurs at the hanger location a resilient support shall be used:
      a. Selection of resilient supports shall be based on permissible load variations and effects on adjacent equipment. Support selection for typical load variations are shown on MSS SP-69 Table 2 (Spring Support Selection). Load and movement calculations shall be made for the proper selection of spring hangers.
      b. Vertical movement and load transfer from riser expansion to horizontal runs shall be given consideration when applying spring hangers.
c. Spring cushion hangers may be used where vertical movement does not exceed 1/4-inch and where formal load and movement calculations are not required.
d. Variable spring hangers shall be used for all other resilient support requirements except as noted in the following paragraph.
e. Constant support hangers shall be used on piping systems where the deviation in supporting force must be limited to 6% and which cannot be accommodated by a variable spring hanger.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification sections.

3.2 HANGER AND SUPPORT INSTALLATION

A. Pipe Hanger and Support 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.

B. General:
1. Adjust all components as required for proper operation and required pipe slope.
2. Double nut all support rods at hangers.
3. Location and Routing:
   a. Install Piping as Indicated:
      1) On the Drawings.
      2) On the reviewed Shop Drawings.
   b. Secure Engineer's approval for all pipe routing changes.
4. Coordinate with other trades for placement of concrete attachments prior to concrete pouring.
5. Install all items in accordance with Manufacturer's instructions.

C. Support at Valves: Provide additional supports at all valves in piping 4-inch and larger.

D. Vertical Risers:
1. Support independently from adjacent hangers on horizontal piping.
2. Copper Piping:
   a. Support at the base and at 6-foot maximum centers for sizes 1-1/4-inch and smaller.
   b. Pipes Larger Than 1-1/4-Inch:
      1) Supported at each floor level.
      2) Not to exceed 10-foot centers.
3. Vertical Threaded, Welded or Grooved Steel Piping:
   a. Support at the base of the riser and at every other floor.
   b. Maximum allowable unsupported piping length is 12 feet.

E. Horizontal Runs:
1. General:
   a. Provide adequate supports for the loads with a factor of safety of at least 5 (400 pounds minimum).
   b. Provide protective shield at all hangers and rollers supporting plastic pipe and coated pipe.
   c. Support spacing not to exceed MSS SP-69 Table 3, or the requirements in the table below, whichever is more stringent.
   d. Hanger rod diameter shall not be less than the requirements of MSS SP-69 Table 4, or the requirements in the table below, whichever is more stringent.
2. Rollers: All piping systems designed to accommodate thermal expansion movement shall be mounted on rollers.
3. Bar Joists: Attachments to bar joists shall be made to top member and at panel points.

F. Ductile Iron Piping: The size of hanger components shall be suitable for the O.D. of the pipe to be supported.

G. Hanger Spacing
1. Install hangers and supports for piping at intervals specified herein after, at locations not more than 3 feet from the ends of each runout, and not over 25% of specified interval from each change in direction of piping.
2. Hanger Spacing:  

<table>
<thead>
<tr>
<th>Maximum Hanger Spacing</th>
<th>Steel</th>
<th>Copper Pipe Size</th>
<th>Rod Size</th>
<th>Pipe Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube ½&quot; &amp; Smaller</td>
<td>3/8&quot;</td>
<td>7/8&quot;</td>
<td>5/8&quot;</td>
<td>20'</td>
</tr>
<tr>
<td>3/4&quot; – 1&quot;</td>
<td>3/8&quot;</td>
<td>7/8&quot;</td>
<td>5/8&quot;</td>
<td>20'</td>
</tr>
<tr>
<td>1-1/4&quot; – 1-1/2&quot;</td>
<td>3/8&quot;</td>
<td>9&quot;</td>
<td>8&quot;</td>
<td>20'</td>
</tr>
<tr>
<td>2&quot;</td>
<td>3/8&quot;</td>
<td>10&quot;</td>
<td>8&quot;</td>
<td>20'</td>
</tr>
<tr>
<td>2-1/2&quot; – 3-1/2&quot;</td>
<td>½&quot;</td>
<td>12&quot;</td>
<td>10&quot;</td>
<td>20'</td>
</tr>
<tr>
<td>4&quot; – 5&quot;</td>
<td>5/8&quot;</td>
<td>14&quot;</td>
<td>12&quot;</td>
<td>20'</td>
</tr>
<tr>
<td>6&quot;</td>
<td>¾&quot;</td>
<td>14&quot;</td>
<td>--</td>
<td>20'</td>
</tr>
<tr>
<td>8&quot; – 12&quot;</td>
<td>7/8&quot;</td>
<td>20&quot;</td>
<td>--</td>
<td>20'</td>
</tr>
<tr>
<td>14&quot; – 18&quot;</td>
<td>1&quot;</td>
<td>20&quot;</td>
<td>--</td>
<td>20'</td>
</tr>
<tr>
<td>20&quot; and Larger</td>
<td>1-1/4&quot;</td>
<td>20&quot;</td>
<td>--</td>
<td>20'</td>
</tr>
</tbody>
</table>

3.3 PIPE RESTRAINTS

A. Provide adequate pipe restraints for all expansion or contraction of piping due to temperature change:
   1. Including, but not limited to, that indicated on the Drawings.
   2. As instructed by Owner or Engineer.
   3. At locations to prevent stresses from exceeding those permitted by ANSI B31 and to prevent transfer of loading and stresses to connected equipment.
   4. Spacing: Unless otherwise indicated, install at ends of main pipe runs, at intermediate joints in pipe runs between expansion loops and bends.

B. Concrete work installed in connection with anchors or supports: Make with approved Portland Cement:
   1. At least 5-1/2 bags per cubic yard.
   2. Properly mixed with approved aggregate.
   3. Attain a compression strength of not less than 3,000 psi at 28 days.

3.4 VIBRATION ELIMINATORS

A. Provide as indicated on the Drawings and in accordance with the requirements of Division 23 Section "Sound and Vibration Control for HVAC."

B. Install so as to cause minimum restraint to normal thermal movements.

3.5 INSULATION PROTECTION

A. Provide Protection Saddle:
   1. Equal to insulation thickness.
   2. At each hanger.
   3. For all insulated piping systems where longitudinal expansion exceeds 1-inch per 100 feet.

B. Provide preservative treated wood block "saddle" for all insulated domestic cold water, chilled water and condenser water piping systems larger than 3-inch IPS. Anvil Fig. 160 to 165 is also acceptable.

C. Provide insulation protection shield:
   1. At each hanger for all "cold" (less than 50 degrees F) piping services.
   2. In accordance with the following table:

<table>
<thead>
<tr>
<th>Pipe Size (IPS)</th>
<th>Shield Gage</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>5&quot; and Smaller</td>
<td>16</td>
<td>12&quot;</td>
</tr>
<tr>
<td>6&quot; to 12&quot;</td>
<td>12</td>
<td>16&quot;</td>
</tr>
<tr>
<td>Greater than 12&quot;</td>
<td>12</td>
<td>20&quot;</td>
</tr>
</tbody>
</table>

3. Installed as follows:
   a. Surround lower covering.
   b. Straddle equidistant on hanger.
   c. Flared at both ends as required to avoid damage to pipe covering, jacket and vapor barrier.
3.6 PAINTING

A. Touchup: Cleaning and touchup of painting of field welds, bolted connections and abraded areas of shop paint on miscellaneous metal are specified in Division 09 Section “Painting.”

B. Galvanized Surfaces: Clean welds, bolted connections and abraded areas. Apply galvanizing repair paint to comply with ASTM A780.

END OF SECTION 23 05 29
SECTION 23 05 31 – PENETRATIONS 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. Refer to Division 23 Section “Seismic and Wind Restraint Controls for HVAC” for seismic and wind restraint requirements related to this section.

1.2 SUMMARY

A. This Section includes the furnishing and installation of the major items listed below:
   1. Duct and pipe sleeves.
   2. Prefabricated and site built curb assemblies.
   3. Flashing and sealing of all mechanical openings through weather or waterproofed walls, roofs and floors.
   4. Sealing and finishing of all mechanical openings.
   5. Provide UL rated firestopping and sealing at all new and existing pipe penetrations of fire rated walls.

B. Division of Work: In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the work to be performed by specific trades. The following are suggestions as to how the Work may be divided. This is not a complete list of all the work:
   1. General Contractor:
      a. Locate and place all sleeved and framed openings as part of constructing the wall and floor surfaces in which the openings occur.
      b. Provide all lintels and required stiffening members for wall and floor openings.
      c. Cut roofing and install flashing for all required openings in proprietary roof membrane systems.
      d. Cut all roof deck openings and provide required framing supports.
   2. Mechanical Subcontractor:
      a. Advise General Contractor of quantity, location and size of all required openings.
      b. Provide all curbs, sleeves, seals, escutcheons and related materials required for finishing, sealing and waterproofing mechanical openings. Furnish all flashing and counterflashing.
      c. Arrange and pay for all openings required after wall, roof and floor construction is complete.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the Work of this Section shall comply with ASTM D2202 - Test Method for Slump of Sealants.

1.4 SUBMITTALS

A. Manufacturer's Literature: For all premanufactured curbs and sealing assemblies.
   1. Manufacturer’s name.
   2. Model number.
   3. Details of construction and installation.
   4. Certified load-bearing data for all curbs.

1.5 PERFORMANCE REQUIREMENTS

A. Design shall not consider shielding by adjacent structures.

1.6 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed submittals.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Curbs:
   1. The Pate Company.
   2. Roof Products and Systems Corporation.
   3. Thycurb Corporation.
   4. A.E.S.
   5. MicroMetl.

B. Pipe Seals and Boots:
   1. The Pate Company.
   2. Portals Plus, Inc.
   4. Thunderline Corporation.
   5. Thycurb Corporation.

C. Modular Mechanical Seals:
   1. Thunderline/Link-Seal.
   2. As approved.


E. Acoustical Sealant: Pecora, “BA-98”.

2.2 MATERIALS

A. Backer Rod:
   1. Extruded round, closed cell, polyethylene foam.
   2. Resilient, non-exuding.
   3. Density: 2.0 pounds per cubic foot.
   4. Tensile Strength: 50 psi.
   5. Nonabsorbent to water and gasoline.
   6. Suitable for use as a backing for acoustical sealant.
   7. Compatible with sealant and approved by sealant Manufacturer.

B. Acoustical Sealant: Nonfire-Rated Penetrations:
   1. Non-drying, non-hardening and non-bleeding.
   2. Laboratory tested sealant which effectively reduces airborne sound transmission through wall systems.
   3. Viscosity: 350,000 to 400,000 (Brookfield No. 65, 10 RPM).
   4. Aging: Firm but rubbery, good tack after 50 days conditioned at 160 degrees F.
   5. Slump: 0.1 to 0.2 inches in accordance with ASTM D2202.
C. Packing Material for Penetrations:
   1. Glass Fiber or Mineral Fiber:
      a. Noncombustible.
      b. Resistant to water, mildew, and vermin.
   2. Expanding Resilient Foams:
      a. Acceptable alternative if manufactured for this purpose.
      b. Minimum material density: 60 pounds per cubic foot.
   3. Fire-Rated Penetrations: Permanently flexible, approved firestop putty. Refer to Division 07 Section "Penetration Firestopping."

2.3 SLEEVES

A. Materials:
   1. 18-Gage Galvanized Steel:
      a. For ductwork openings.
      b. For pipe penetrations in non-bearings walls.
   2. Schedule 40 Steel Pipe:
      a. For all bearing walls.
      b. For all floors.
      c. For all concrete or masonry walls.

B. Size All Sleeves:
   1. To allow for movement due to expansion, without contact to pipe or insulation.
   2. To provide for continuous insulation, except as required by Division 07 Section “Penetration Firestopping.”
   3. As indicated on the Drawings.

2.4 MANUFACTURED UNITS

A. Structural Roof Curbs:
   1. Frames:
      b. Corners: Mitered and welded (welds are micro sealed and prime painted after fabrication). Bolted connections are not accepted.
      c. Base Plates: Integral to frame and welded.
      d. Internally reinforced with galvanized 1-inch x 1-inch angles for curbs exceeding 3-foot length. Reinforce internal bulkhead at equipment curbs to support lateral loads.
      e. Wood Nailers: Factory installed, decay resistant. Size and width as suitable for support of items installed on curbs and perimeter of roof deck.
   2. Curb Height:
      a. Minimum 12 inches above finished roof surface. Select roof curb so mechanical equipment air inlets are at least 18 inches above the finished roof surface.
      b. Select curb height so that grease duct flange/top of curb is at least 18 inches above finished roof surface with base set on roof structure under the roof decking.
   3. Construct curbs to match roof slope with plumb and level top surface for mounting mechanical equipment.
   4. Gasketing: 1/4-inch thick, 1-inch wide under all units.
   6. Insulation: Minimum 1-1/2-inch, 3-pound density fiberglass insulation.
   7. Curb assembly shall be installed under metal roof deck. Perimeter steel roof deck shall be supported by structural curb assembly. Structural curb bottom flange shall be a minimum width of 2 inches to support roof deck. Steel clips shall be provided where roof deck flutes do not contact bottom flange of structural curb, to prevent crushing roof deck.
   9. Curbs for fans and similar mechanical equipment items are furnished by equipment Supplier unless specified otherwise.
B. Exterior Wall or Roof Pipe Opening Seals:
   1. Compatible with installation conditions.
   2. Equal to One of the Following:
      a. Pate "Pipe Seal".
      b. Pate “Pipe Curb Assembly”.
   3. Link-Seal.

C. Modular Mechanical Seals:
   1. Provide modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to
      continuously fill the annular space between the pipe and the wall opening.
   2. The elastomeric element shall be sized and selected in accordance with Manufacturer's
      recommendations and have the following properties as designated by ASTM:
      a. For Standard Service Applications:
         1) -40 to +250 degrees F (-40 to +121 degrees C).
         2) EPDM = ASTM D2000 M3 BA510.
      b. For High Temperature or Fire Seal Applications:
         1) -67 to +400 degrees F (-55 to +204 degrees C).
         2) Silicone = ASTM D2000 M1GE505.

PART 3 - EXECUTION

3.1 ROOF OPENINGS

A. Ducts:
   1. Pass through prefabricated curbs.
   2. Curb Counterflushing:
      a. Solder or pop-rivet with mastic to the duct and extended over and down the top of the curbs for a
         minimum distance of 2 inches.
      b. Secure to the sides of the wood strips with corrosion-protected lag screws and washers 12 inches
         on center.

B. Piping:
   1. As indicated on the Drawings.
   2. For Multiple Pipes Through Single Opening:
      a. Select sleeve or opening seals of ample size to accommodate pipes.
   3. Fill Annulus Opening:
      a. Use non-combustible insulation material.
      b. Full depth of sleeve.
   4. Provide Moisture Protection Using Premanufactured:
      a. Elastomeric boot.
      b. Metal hood.
      c. Flashing fitting.

C. Locate curbs and sleeves a minimum of 12 inches from walls to permit proper flashing.

3.2 INTERIOR WALL AND FLOOR OPENINGS

A. Seal airtight all openings around pipes and ducts in the structure at:
   1. Mechanical equipment rooms.
   2. All enclosed shaft penetrations.

B. Duct Penetrations:
   1. Where each duct passes through a wall, floor, or ceiling, there shall be a clear annular space of 1-inch
      (25 mm) between the duct and structure.
   2. Frame, sleeve, or grout all voids in opening perimeter to contain packing material.
   3. After all of the ductwork is installed, check the clearance, and pack the voids full depth with packing
      material. In noise-critical walls and floors, calk both ends with acoustical sealant backed by a backer rod
      or permanently flexible firestop material.
4. Where there is not sufficient access space to pack around all sides of a duct (for example, at the underside of a slab), first place a short stub duct in the wall, pack and calk around it, and then attach the inlet and outlet ducts to each end.

5. Where ducts enter or leave a shaft or pass through a wall or slab in sufficient numbers and density that individual pack-and-calk details are not possible, special isolation details shall be developed:
   a. Before the shaft is fully enclosed, seal the penetration with a heavy membrane surrounding the ducts on each side of the wall or slab being penetrated.
   b. Each membrane may be 2 layers drywall, 1-inch (25 mm) plaster or 14-gage lead sheet.
   c. Other materials may be acceptable.
   d. Pack the void between the 2 membranes with packing material or pump full of resilient closed cell firestop foam.
   e. Calk all edges airtight.
   f. In all cases, the proposed detail shall be approved by Engineer.

C. Pipe Penetrations:
   1. HVAC Piping:
      a. Where a pipe passes through a wall, ceiling, or floor, place cast or grout a sleeve into the structure.
      b. Internal diameter of the sleeve: 2 inches (50 mm) larger than the external diameter of the bare pipe or pipe insulation O.D. passing through it.
      c. After all of the piping is installed in a specific area, check the clearance and correct it, if necessary, to within 1/2-inch (12 mm).
      d. Pack the void full depth with packing material and seal at both ends, with minimum 1-inch (25 mm) deep sealant.
      e. In noise-critical walls and floors, pack with acoustical sealant backed by foam rod.
      f. Where pipes pass through a masonry wall in sufficient numbers and density that individual pack-and-calk details are not possible, a special isolation detail shall be developed:
         1) Cast pipe sleeves in a block of concrete with the sleeves located a minimum of 2 inches (50 mm) apart.
         2) Block thickness: At least as thick as the surrounding wall construction.
         3) Each sleeve diameter: 2 inches (50 mm) larger than the external diameter of the pipe passing through it.
         4) Build the sleeved block into the wall.
         5) After the pipes are installed, pack and calk voids as indicated above.

3.3 OUTSIDE WALL OPENINGS

A. Ducts:
   1. Pass through openings provided by Contractor.
   2. Size opening to allow approximately 1-inch clearance at all duct or duct covering surfaces.
   3. Provide sheet metal closures, insulation, calking, flashing and drip edges.
   4. Install to ensure 100% weatherproof construction.

B. Pipes:
   1. Pass through sleeves fabricated of Schedule 40 pipe cut 3/8-inch back from face of wall on each side.
   2. Sealed 100% watertight.

3.4 ESCUTCHEONS AND CLOSURE COLLARS

A. Includes penetrations of ceilings, partitions, floor and walls.

B. Provide Escutcheons for All Piping Exposed to View:
   1. As indicated on the Drawings.
   2. Sized to fit over coverings.
   3. In All Dry Finished Areas: Chrome plated.
   4. Do not use escutcheons in acoustic isolation walls unless otherwise indicated.
C. Provide Sheet Metal Closure Collar for all Ductwork:
   1. Fit snugly around duct or covering, and surface penetrated without contact.
   2. Attach with approved fasteners 6-inch centers maximum spacing.
   3. Fabricate with minimum 4-inch face.

END OF SECTION 23 05 31
SECTION 23 05 46 – SOUND AND VIBRATION CONTROL 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 the furnishing and installation of all equipment for and related items incidental to isolation and attenuation of mechanical vibration and sound:
   1. Major Items:
      a. Isolate mechanical rotating or vibrating equipment with vibration isolators.
      b. Connect ductwork and piping to equipment by means of flexible connections.
      c. Install mechanical equipment, piping and ductwork on, or suspended from, approved and specified foundations or supports.
   2. All vibration isolation devices shall be furnished by a single Manufacturer.

B. Division of Work: In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the work to be performed by specific trades. The following are suggestions as to how the Work may be divided. This is not a complete list of all the work:
   1. General Contractor: Provide concrete equipment pads.
   2. Mechanical Subcontractor:
      a. Provide miscellaneous structural steel necessary for support of mechanical work.
      b. Coordinate necessary alterations in structural steel.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   3. ASTM:
      h. G21 - Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
      i. G22 - Practice for Determining Resistance of Plastics to Bacteria.
   5. NFPA Standard:
      a. 90A - Installation of Air Conditioning and Ventilating Systems.
   6. SMACNA: HVAC Duct Construction Standards - Metal and Flexible.
   7. UL: 181 - Factory-Made Air Ducts and Air Connectors.

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

A. The isolation materials Manufacturer shall be responsible for the proper selection of isolators to achieve the specified minimum static deflections, for all isolators, based on the actual weight distribution of equipment to be isolated.
B. The isolation materials Manufacturer shall be responsible for the structural design of steel beam bases and concrete inertia bases, to support mechanical equipment scheduled to receive such supplementary bases.

C. Be responsible for verifying the completeness of the isolation installation and the overall suitability of the equipment to meet the intent of this Specification. All additional equipment needed to meet the intent of this Specification, even if not specifically mentioned herein or in the Contract Documents, shall be supplied by the Contractor without claim for additional payment.

D. Sealing of Penetrations: Designated building structures designed to isolate air-borne noise surrounding all critical and noisy spaces. Proper routing of and sealing or lagging (enclosure), or both, around mechanical services penetrating these structures are necessary to maintain the integrity of the isolating structure.

1.5 NOISE CRITICAL SPACES

A. Areas of this building require special attention (special acoustical provisions and restrictions) to the allowed background noise levels. The following areas are designated as “noise-critical” spaces:
   1. Mechanical Rooms.

B. Noise-critical walls are [ indicated on the architectural Drawings ] [ all walls enclosing the above spaces ], and include spaces that contain noise producing equipment in addition to the “noise-critical” spaces listed above. Noise-critical slabs are those slabs (and all associated isolated ceilings or floating floor slabs) that are above and below rooms enclosed by noise critical walls.

C. Penetrations of noise critical walls and slabs by ducts, pipes, and conduit shall be sleeved, packed, and sealed airtight with non-hardening sealant as described in Division 23 Section “Penetrations for HVAC.”

1.6 SUBMITTALS

A. Manufacturer’s Literature: For all products described under Part 2 of these Specifications.
   1. General:
      a. Dimensions.
      b. Construction details.
      c. Manufacturer’s name.
      d. Model number.
   2. Spring Isolators:
      a. Rated deflection.
      b. Spring constant.
      c. Model number.
      d. Type of isolator.
      e. Size.
      f. Height when uncompressed and maximum allowed static deflection.
      g. Isolator location shown on an outline of the isolated equipment.
      h. Detail drawings of inertia bases isolators.
      i. Location of isolators on plan drawings of the isolated area, where applicable.
      j. The weight of all isolated equipment, and the loads on each isolator and the static deflection of each isolator under the specific design load shall be listed along with the proposed isolators.
      k. Pipe isolators shall be shown and identified on piping layout Drawings.

B. Furnish a complete set of approved Shop Drawings of all mechanical and electrical equipment to receive vibration isolation devices to the vibration isolation materials Manufacturer, based upon the selection of vibration isolators and design of supplementary bases will be completed. The Shop Drawings to be furnished shall include operating weights of the equipment to be isolated and the distribution of weight at support points.

1.7 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.
B. Manufacturer or Qualified Representative Services:
   1. Provide necessary field supervision.
   2. Ensure correct installation and adjustment.

C. Regulatory Agencies Requirements:
   1. Comply with all state and local codes and ordinances.
   2. Insulation, facing, and adhesive shall have a composite rating:
      a. 25 flame spread maximum.
      b. 50 smoke developed maximum.
      c. In accordance with NFPA 255.
   3. Installation of acoustic duct liner shall be in accordance with:
      a. SMACNA - HVAC Duct Construction Standards - Metal and Flexible:
         1) Acoustical Liner Installation Standards.
         2) Mechanical Fastener Standard.
      b. NAIMA - Fibrous Glass Duct Liner Standards.

1.8 DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer’s directions.

C. Reject damaged, deteriorated, or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Flexible Duct Connectors:
   1. Ventfabrics; “Ventglas and Ventsil”.
   2. Duro Dyne; “Neoprene”.

B. Vibration Control: All vibration control apparatus shall be provided by a single Manufacturer except as specifically noted herein:
   1. Amber-Booth.
   2. Mason Industries, Inc.
   3. Vibron.

C. Vibration Isolation Curbs:
   1. Pate.
   2. Kinetics.
   3. Mason.

D. Acoustic Duct Liner:
   1. Johns Manville; “Permacote Linacoustic Standard duct Liner”.
   2. Certainteed “Toughgard” with Enhanced Surface”.
   3. Equivalent by Knauf.
E. Acoustic Duct Liner Adhesives:
   1. Foster Products.
   2. Childers
   5. Goodloe E. Moore.
   6. Precision Adhesive, Inc.
   7. Mon-Eco Industries, Inc.

2.2 MATERIALS

A. Acoustic Duct Liner:
   1. Thermosetting resin bonded mat of dual density glass fiber coated on airstream side with an immobilized
      EPA registered anti-microbial agent.
   2. Density: 1.9 pounds/cubic foot.
   4. Thermal Conductance (c): 0.24 at 75 degrees F mean temperature.
   5. Acoustical Performance:

<p>| Minimum Sound Absorption Coefficients at Octave Band Center Frequencies (Hz) |</p>
<table>
<thead>
<tr>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1,000</th>
<th>2,000</th>
<th>4,000</th>
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<tr>
<td>0.09</td>
<td>0.29</td>
<td>0.67</td>
<td>0.89</td>
<td>1.03</td>
<td>0.99</td>
<td>0.70</td>
</tr>
</tbody>
</table>

   6. Facing:
      a. Factory-applied black acrylic coating.
      b. Fire-Resistant:
         1) Comply with NFPA 90A.
         2) UL listed.
         3) 25 flame spread and 50 smoke developed rating.
      c. Rated for velocities at 5000 fpm tested in accordance with UL 181 without wearing of the surface
         or entrainment of glass fibers into air stream.
      d. Designed to minimize friction loss.
      e. The insulation must be resistant to microbial growth as determined by:
         1) UL 181: Mold Growth and Humidity Test.
         2) ASTM C1071: Fungi Resistance Test.
   7. Use Johns Manville “Permacote Superseal” for edge coating and in areas requiring repair.

B. Duct Liner Fasteners:
   1. Mechanically Secured:
      a. 12-gage galvanized steel.
      b. Impact-driven into duct.
      c. Form positive mechanical attachment to sheet metal.
      d. Fastener shall not compress the insulation more than 1/8-inch.
   2. Weld-Secured:
      a. Attached to Duct by:
         1) Resistance welding.
         2) Capacitance discharge welding.
      b. Fastener Head:
         1) 0.075 square inch minimum area.
         2) 0.01-inch minimum thickness.
         3) Cupped or beveled.
         4) Shall not compress the insulation more than 1/8-inch.
C.  Acoustic Duct Liner Adhesives:
   1. As recommended by Manufacturer of insulation.
   2. Solvent or water-based.
   3. Fire-resistant: 25 flame spread and 50 smoke developed rating.
   5. Manufacturers:
      a. Foster 85-60 / 85-20.
      b. Childers CP-127 / CP-82.
      c. Duro-Dyne SSG.

2.3 VIBRATION ISOLATION EQUIPMENT

A. Flexible Duct Connectors:
   1. Flexible sleeves for duct connections shall be fabricated from flexible, airtight, coated fabric. Each sleeve shall be installed with at least 3 inches (75 mm) slack across a clear metal to metal gap of at least 4 inches (100 mm). That is, 7 inches (175 mm) of this fabric is required for each sleeve.
   2. Standard Temperature Type:
      b. Coated Fabric Weight: 30 ounces per square yard.
      c. Thickness: 0.024 inches.
      d. Temperature Range: -20 to 200 degrees F.
      e. Tensile Strength:
         1) 480 pounds per inch warp.
         2) 360 pounds per inch fill.

B. Vibration Isolation Curb:
   1. Isolation assembly shall consist of extruded aluminum upper and lower members incorporating cadmium plated steel springs with 1-inch static deflection and insuring uniform deflection for the entire system.
   2. Spring diameter shall be equal to or greater than the loaded spring height and shall be equal to 50% of the rated deflection.
   3. A continuous flexible waterproof seal shall be riveted to both upper and lower members. Assembly shall include both upper and lower gasket material.

C. Spring Isolators:
   1. Isolator Type CSNM:
      a. Type CSNM (constrained spring and neoprene mounts) shall be a spring and neoprene mount that incorporates a housing which includes vertical limit stops to prevent spring expansion when weight (water or other fluid) is removed from the equipment and limits the movement of equipment when it is subjected to wind loading. A minimum clearance of 1-inch (25 mm) shall be maintained around restraining bolts and between the housing and the spring, so as not to interfere with the spring operation. Limit stops shall be out of contact during normal operation, backed away from contact by at least 1/2-inch (12 mm); a neoprene washer shall be installed beneath the bolt head/washer used to restrain the isolator. In outdoor rooftop installations isolators must be bolted to the roof or supporting structure with a neoprene mounting sleeve.
      b. Unless otherwise specified, the minimum static deflection for Type CSNM mounts shall be 2 inches (50 mm).
      c. Type CSNM: Mason Industries Type SLR; or as pre-approved by Engineer.

D. Neoprene Mounting Sleeves: Neoprene mounting sleeves for hold-down applications of equipment with vibration isolators shall be Uniroyal Type 620/660; or as pre-approved by Engineer.

E. Pipe Flexible Connectors:
   1. Isolator type PFC (pipe flexible connectors) shall be Kevlar-reinforced neoprene, single or double-sphere design. Flexible connectors with control rods will not be permitted.
   2. Type PFC: Mason Industries “Safelex” Type SFEJ or SFDEJ; or as approved by Engineer.
PART 3 - EXECUTION

3.1 GENERAL

A. Unless otherwise indicated, all equipment mounted on vibration isolators shall have a minimum operating clearance of 2 inches (50 mm) between the bottom of the equipment or inertia base (and height-saving bracket) and the concrete housekeeping pad (or bolt heads, whichever is closest) beneath the equipment. The clearance shall be checked to ensure that no scraps have been left to short-circuit the vibration isolators. There shall be a minimum 4-inch (100 mm) clearance between isolated equipment and the walls, ceiling, floors, columns, and any other equipment not installed on vibration isolators.

B. Piping, ductwork, conduit or mechanical equipment shall not be hung from or supported on other equipment, pipes, or ductwork installed on vibration isolators. It shall be supported on or suspended from building structure.

C. Equipment connected to fluid piping shall be erected on isolators or isolated foundations at correct operating heights prior to connection of piping. Equipment should be blocked-up with temporary shims to final operating height. When the system is assembled and fluid is added, the isolators shall be adjusted to allow removal of the shims, and confirm that the isolators for the fluid-filled pipes, pumps, and other elements deflect the specified amounts and no more.

D. All mechanical equipment not specifically identified in this Specification that contains rotating or vibrating elements, and all associated electrical apparatus installed by this division that contains transformers or inductors shall be installed on Type DDNM or RBA neoprene isolators as appropriate. In all such instances, submit the proposed isolators with the isolator Shop Drawings.

E. All isolators that are to be installed outdoors or exposed to the weather shall be hot-dipped galvanized and shall be furnished with neoprene mounting sleeves for hold-down bolts to prevent any metal-to-metal contact.

F. Elastomeric isolators that will be exposed to temperatures below 32 degrees F (0 degrees C), shall be fabricated from natural rubber instead of neoprene.

G. Wiring:
   1. All wiring connections to mechanical equipment on vibration isolators (either spring or neoprene type) shall be made with a minimum 36-inch (1 m) long flexible conduit in a 360-degree loop.
   2. All ties used to form the loop shall be removed prior to adjusting the isolators.

3.2 FAN ISOLATION

A. General:
   1. Fans in air handlers shall be mounted on vibration isolators as described herein.
   2. Fans in air handling units shall be leveled with the fans operating before the flexible connectors are attached.
   3. All fan bases and isolators shall be sized so that thrust restraints (which would act against turning moment caused by static pressure) are not required.
   4. Fan plenums, air mixing plenums, and package air handler plenums shall be installed on a 4-inch (100 mm) high reinforced concrete housekeeping pad, and with a continuous Type WP neoprene isolator at the entire perimeter of the base.

B. Roof-Mounted Equipment:
   1. Roof-mounted condensing units, packaged air-conditioning units, and fans shall be installed on rooftop isolation curbs using Type CSNM isolators.
   2. All hardware must be plated or galvanized to provide a rust-resistant finish. Weather-proofing shall be provided by a continuous flexible seal.
   3. All springs shall have removable waterproof covers to allow for adjustment or replacement of the springs.
3.3 SHEET METAL DUCTWORK

A. Duct Isolation: Ducts shall be connected to fans, fan casings, and fan plenums by means of flexible connectors. Flexible duct connectors shall not be used outside the mechanical room in systems serving noise-critical spaces unless expressly indicated on the Drawings.

B. Ductwork Fabrication: Fabricate ductwork so as to be free from vibration, rattle, or drumming under all operating conditions; provide all materials necessary for specified construction, whether or not they are specifically called for or detailed on the Drawings.

C. Bracing of Ductwork: Do not install tie rods inside ducts.

D. Ductwork Wall Penetrations: Seal around ductwork wall penetrations as specified in Division 23 Section “Penetrations for HVAC.”

3.4 MISCELLANEOUS EQUIPMENT

A. Chiller: Each chiller shall rest on Type MWP neoprene sandwich pads on a 4-inch concrete housekeeping pad. All piping and conduit connections shall be isolated with flexible connectors and supported with Type DDNH isolators.

B. Flexible Duct Connectors:
1. Install at duct connections to air moving equipment.
2. Install at locations indicated on Drawings.

C. Transfer Silencers:
1. Install at all locations as indicated on Drawings.
2. Seal around transfer silencer wall penetrations as specified in Division 23 Section “Penetrations for HVAC.”

3.5 ACOUSTIC LINING OF DUCTS

A. Application:
1. Ducts (where noted), shall be acoustically lined internally:
   a. All ductwork used exclusively to transfer air connected to one room to another.
   b. Where indicated on the Drawings.
2. Ductwork Not to be Lined:
   a. Outside air intakes.
   b. Supply air ductwork.
   c. Relief air ductwork.
   d. Exhaust ductwork.
   e. All ductwork conveying or potentially conveying unfiltered or untempered outside air or mixed air.

B. Thickness:
1. Lining shall be 1-inch (25 mm) thick in all internally lined sheet metal ducts, unless otherwise specified or indicated on the Drawings.
2. Where internal lining is also specified in Division 23 Section “Duct Insulation” for thermal duct lining, the greater thickness shall be used.

C. Installation:
1. The acoustic liner shall be fixed to the duct with a minimum of 50% coverage of a fire-resistant adhesive. All perimeter acoustic liner edges shall be coated with adhesive.
2. Where the duct width exceeds 12 inches (300 mm) or a height of 24 inches (600 mm), the liner shall be additionally secured with mechanical fastening on maximum 16-inch (400 mm) centers, and no more than 3 inches from ductwork edges or insulation joints.
3. Mechanical fasteners that pierce the duct are unacceptable.
4. All portions of duct specified to receive acoustic liner shall be completely covered.
   a. Transverse joints shall be neatly butted and there shall be no interruption or gaps.
   b. All transverse edges are to be 100% covered with Manufacturer-supplied edge coating.
   c. Cut liner to ensure tight corner joints.
   d. All corner joints are to be either lapped and butted, or folded.
   e. Black coated surface is to face air stream.
5. Acoustic liner shall be 100% covered with Manufacturer supplied coating at all exposed surfaces, edges, and transverse joints.
6. Where acoustic duct lining is installed, the dimensions of the sheet metal shall be increased to include the thickness of the lining material. Dimensions indicated on the Drawings are the net clear internal dimensions after the acoustic liner has been installed.
7. Exposed and leading edges will be covered with metal nosing around the entire perimeter.

3.6 FIELD QUALITY

A. Work in accord with best trade practices, fabricate and install all items in accordance with Manufacturer’s recommendations and Engineer’s directions, and consult with trades doing adjoining work in order to provide an installation of first class quality.

3.7 ADJUSTMENT AND TESTING

A. Vibration Isolation Report:
   1. The vibration isolation Manufacturer shall inspect and approve the installation of the vibration isolators and shall submit a report to [Engineer] [Owner] which verifies that all of the isolation equipment has been properly installed and that the installation is in full conformance with the Specification.
   2. The report shall record the model or type of each isolator.
   3. For isolators containing steel springs, the report shall also record the size and uncompressed height, design static deflection, and measured static deflection of the isolators provided.

B. Site Access: During installation of equipment, arrange for access as necessary for inspection of isolation and noise control equipment by Engineer.

END OF SECTION 23 05 46
SErCT 23 05 73 – TESTING AND CLEANING OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes providing testing and cleaning services and the major items listed below:
   1. Provide all pumps, gages, valves and other equipment and material necessary to properly conduct tests and perform cleaning.
   2. Provide all equipment, material, labor and testing required to properly pacify hydronic system piping so that it may be integrated into the existing hydronic system with no adverse effects or contamination.
   3. Arrange and pay for all costs of utilities and chemicals required for the Work.
   4. Repair and Restore All Work Damaged:
      a. By tests.
      b. By cutting required in connection with the tests.

1.3 REFERENCES

A. American National Standards Institute/Institute of Inspection Cleaning and Restoration Certification (ANSI/IICRC).
   1. ANSI/IICRC S520 - Standard for Professional Mold Remediation.


C. National Fire Protection Association (NFPA):


E. Sheet Metal and Air Conditioning Contractors’ National Association (SMACNA):
   1. HVAC Duct Construction Standards - Metal and Flexible.

F. Underwriters’ Laboratories (UL):

G. US Green Building Council (USGBC).

1.4 SUBMITTALS

A. Flushing and Cleaning:
   1. Submit certificates for all code-required inspections.
   2. Submit all water Sample analysis reports as required in Part 3 of these Specifications.
   3. Submit all duct cleaning chemicals to be used.

B. Pressure Test Reports:
   1. Submit within 1 week after each system pressure test.
   2. List time, date and persons present for the following for each system:
      a. Initial tests.
      b. Final test.
3. Include report indicating:
   a. Test type and duration.
   b. Initial pressure.
   c. Final pressure.
4. Indicate that necessary repairs and final tests were satisfactorily completed.

1.5 QUALITY ASSURANCE

A. Comply with all applicable codes.

B. Secure State Health Department approval for potable water systems.

C. Testing and Cleaning Agency:
   1. Minimum 15 years’ experience in providing cleaning chemicals for water systems use.
   2. Provide regional laboratory support services.
   3. HVAC System Cleaning Contractor: Current member of NADCA experienced in HVAC cleaning projects of similar size and complexity.

PART 2 - PRODUCTS

2.1 CLEANING AGENT MANUFACTURERS

A. Aqua-Chem.

B. Aquatrol.

C. Enerco.

D. Nalco.

2.2 MATERIALS

A. Detergents, solvents, and other cleaning agents shall be compatible with materials of fabrication of systems where they are used. No cleaning agent shall adversely affect materials or mechanisms in systems and cleaning agents shall be acceptable to equipment manufacturers and the Owner’s environmental coordinator.

B. Detergents, solvents, and other cleaning agents shall be compatible with process streams to be handled by systems in which the cleaning agents are used.

C. Owner will provide water for cleaning and flushing. Other cleaning fluids, agents, and equipment shall be provided by Contractor.

D. Hydronic systems shall use the following products or an equal substitute and shall be approved by the Engineer prior to flush.
   1. Use a nitrite based solution, as recommended by Manufacturer, prior to any other for the removal of iron oxides from the metal surfaces, and passivation of the base metal.
   2. The solution shall be circulated until a steady iron concentration is reached in the circulating water. As the solution dissolves iron oxide deposits, ferric hydroxide is formed and the pH rises it is necessary to maintain a pH range of 9 to 9.5. Therefore, supplemental feeding of the solution may be required in extremely dirty systems.
   3. A sodium nitrite based corrosion protection shall be placed in the pacified pipe after the system has been cleaned and flushed.

E. Provide all necessary temporary equipment required for cleaning and flushing operations.
F. Pipe Cleaning:
   1. Provide permanent hose connections for supply, discharge and recirculating lines for the new piping system.
   2. Provide piping at the ends of the main and branch lines of the piping system as required to accomplish flush of the piping.
   3. Provide a temporary pump of sufficient head and GPM required to achieve a flushing velocity of at least 10 feet per second.
   4. Provide temporary chemical skids with tote tanks as required for mixing chemicals and serving as a source reservoir and/or collection point for cleaning and flushing solutions.
   5. Provide temporary bag filters (with filter bags) as required for removal of contaminants from flushing process.
   6. Provide all hose, electrical leads and supply connections for completion of system required to fill, drain and refill of the lines utilizing plant supplied water and power.

PART 3 - EXECUTION

3.1 PIPING SYSTEM PRESSURE TEST

A. General:
   1. Perform all tests before piping is painted, covered, concealed or backfilled.
   2. Before testing, remove or otherwise protect from damage, control devices, air vents, fixtures, meters, or other parts which are not designated to withstand test pressures.

B. Test Procedures:
   1. Air Test:
      a. Charge with air to the test pressure specified.
      b. When possible, perform test when ambient air temperature is constant.
   2. Soap Test:
      a. Charge with air, water or carbon dioxide to pressure specified.
      b. Examine all joints for leaks with a soap suds solution.
   3. Water Test:
      a. Charge with water to the pressure specified.
      b. Exterior Surface of Pipe and Fittings:
         1) Show no cracks or other form of leaks.
         2) Completely drip dry.

C. Pressure Test Criteria:
   1. Test criteria below are minimum requirements. In addition, the requirements of State and Local Codes having jurisdiction shall be met:

<table>
<thead>
<tr>
<th>Piping System</th>
<th>Type Test</th>
<th>Pressure</th>
<th>Allowable Pressure Drop</th>
<th>Minimum Test Duration</th>
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<tbody>
<tr>
<td>Drainage System</td>
<td>Water</td>
<td>5 psig</td>
<td>0 psi</td>
<td>30 Minutes</td>
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<tr>
<td>Vent System</td>
<td>Water</td>
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<td>0 psi</td>
<td>30 Minutes</td>
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<td>2 psi</td>
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<tr>
<td>Gas *</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

* See below for natural gas piping pressure tests.

2. Natural Gas Piping:
   a. Natural gas piping shall be tested in accordance with NFPA 54, Sections 8.1.4.2 and 8.1.4.3.
   b. Test pressure to be used shall be no less than 1-1/2 times the proposed maximum working pressure, but not less than 3 psi.
   c. Where the test pressure exceeds 125 psi (862 kPa), the test pressure shall not exceed a value that produces a hoop stress in the piping greater than 50 percent of the specified minimum yield strength of the pipe.
d. Test duration shall be not less than 1/2 hour for each 500 cubic feet (14 cubic meter) of pipe volume or fraction thereof. When testing a system having a volume less than 10 cubic feet, the test duration shall be a minimum of 10 minutes. The duration of the test shall not be required to exceed 24 hours.

3.2 REFRIGERANT SYSTEM TESTING AND EVACUATION

A. Each Air Conditioning System:
   1. Pressure Test:
      a. Pressure test using nitrogen (N\textsubscript{2}) gas.
      b. Pressurize the system to 25 psig.
      c. Check for leaks.
      d. Once the system is tight, pressurize with additional nitrogen and small amount of refrigerant to obtain minimum rated design pressure.
      e. Hold this pressure for 12 hours.
      f. Notify Engineer 24 hours in advance of test.
   2. Evacuation:
      a. Evacuate to 500 microns (reading must be taken from a system point furthest away from the vacuum pump).
      b. Hold for 12 hours with the pump isolated.
      c. Must be witnessed and approved by Engineer's representative prior to breaking the vacuum.
      d. On large systems, evacuation may be done in sections, as long as positive isolation can be achieved.

B. Ensure maximum cleanliness of all refrigerant piping.

C. Dehydrate piping in an approved manner.

D. Do not cover or anchor piping until testing is complete and all leaks properly eliminated.

3.3 PIPE FLUSHING AND CLEANING PROCEDURES

A. Prior to Flushing:
   1. Remove orifice plates, traps, strainer elements, flow control valves, etc. prior to or during process of cleaning. Remove instruments which might be damaged by cleaning procedures. Replace such items with spool pieces, plugs, or blind flanges. A "blind list" shall be prepared listing where blinds have been installed for cleaning and shall be provided to Owner after cleaning is complete to verify that all blinds have been removed.
   2. Items removed from piping system shall be cleaned separately.
   3. Lock valves in open position.
   4. Use new gaskets and thread lubricants when removed items are reinstalled after cleaning.
   5. Temporary Bypass Piping: Provide full size bypass piping and valves at coils and heat exchangers such that the coils and heat exchangers can be isolated.
   6. Temporary Strainers: Disconnect piping to be flushed from equipment or install temporary strainers immediately upstream of such equipment.

B. System Protection:
   1. Protect piping and equipment against overpressure, collapse from vacuum, and hydraulic shock during flushing and draining procedures.
   2. Exercise special care with polyvinyl chloride (PVC) and fiberglass-reinforced plastic (FRP) piping and upon initial filling of long pipe runs to determine that pipe is in contact with hangers and supports before filling. Piping bowed out of hangers or supports will settle or lengthen during filling and resulting forces may be damaging at changes in direction.
   3. Install high point vents and low point drains required to remove trapped air and to drain flushing liquid.
C. Hydronic Piping Systems Flushing and Cleaning:
1. Thoroughly flush with water to remove pipe dope, slushing compounds, oils, welding slag, loose mill scale and other extraneous materials. Open all valves to ensure cleaning of entire system.
2. Apply detergent and operate system in accordance with water treatment service organizations recommendations, circulating for a minimum of 8 hours:
   a. Use only equipment and chemicals furnished by a qualified water treatment service organization.
   b. Determine loop capacity by metering fill with all air bled out.
   c. Isolate alkaline cleaners from cooling towers and aluminum and galvanized surfaces.
   d. Place all control valves in open position for filling and venting.
3. Flush through the piping mains from the extreme end to extreme end of the system until solution is well mixed and stable. Recirculate the water through the piping system until the desired cleanliness has been achieved. If the water is very dirty and the tote tank does not provide enough settling time to remove the debris prior to being suctioned out by the Contractor provided recirculation pumps, install a temporary bag housing with a filter or wire mesh strainer in the flowpath.
4. After the mains have been flushed, flush the branch lines starting with the branch closest to the supply point and progress toward the extreme end of the piping that is furthest from the source. Repeat the flushing through each branch until the desired cleanliness has been achieved.
5. Collect water samples and label them with a location and time/date, for analysis of cleanliness. Continue to sample the new piping system piping until it is completely flushed clean of all contaminants and matches the influent source for cleanliness.
6. When desired cleanliness has been achieved, drain all flushing water from the system and then refilled, circulated throughout the mains and branches to rinse out the flushing chemicals, and dumped again.
7. Restore all piping to its design state (remove all temporary piping and close all valves), and refill the system with water and the proper amount of pacifying chemical as directed by the chemical supplier. Recirculate the chemicals throughout the system for a sufficient amount of time as the chemical supplier requires for proper mixing and metal exposure.
8. Drain the system, refill with water and coordinate with the Owner to open the new piping to the existing hydronic system for final mixing of Owner’s chemical into the newly refilled piping via the existing system pumps and chemical injection system.
9. In the event that the new piping is not to be integrated into the existing hydronic system for more than a month, coordinate with the Owner as to whether the system is to remain in "wet layup" with the pacifying chemicals in place or "dry layup" in which case the piping is to be drained and a nitrogen purge applied.
10. Drain the system, refill with water and Owner furnished chemicals as directed by the Owner.
11. Process Fluids piping shall be placed in “dry layup” as specified.
12. After the system has been cleaned:
   a. Test water Sample and submit analysis to Engineer.
   b. Water Sample shall exhibit neutral pH and no turbidity.

D. Natural Gas Piping Systems:
1. Blow clear using oil-free compressed air.
2. Prior to pressure testing and final equipment connection.

3.4 CLEANING AND FINISHING

A. Comply with the requirements of Division 01 Section “Cleaning and Waste Management.”

B. After tests have been made and the system pronounced tight:
1. Clean piping and equipment.
2. Lubricate bearings.

C. Final cleaning includes but is not limited to the following:
1. Equipment with Factory Finishes:
   a. Wash factory-finished equipment with mild soap and water and leave in first-class condition, entirely free of stains or streaks.
   b. Do not use abrasive materials.
   c. Touch up scratches or other violations of the factory finish paint with matching paint from the equipment Manufacturer.

END OF SECTION 23 05 73
SECTION 23 05 76 – VIBRATION TESTING OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the performance of all equipment vibration tests as specified herein and as necessary for the proper and complete performance of the Work.

1.3 SUBMITTALS

A. Submit vibration consultant's vibration test report to Engineer.

1.4 QUALITY ASSURANCE

A. All testing shall be performed by a qualified vibration consultant approved by the Engineer.

B. All vibration measurements and analysis shall be made with instruments traceable to the National Bureau of Standards Criteria, such as International Research and Development Corporation (IRD) Microprocessor Analyzer Balancer - Model 880; or approved equal.

PART 2 - PRODUCTS

2.1 Not used.

PART 3 - EXECUTION

3.1 VIBRATION TESTS

A. General:
   1. Required for all equipment 10 horsepower (7.5KW) and above.
   2. Provide in conjunction with initial equipment start-up.
   3. Contractor: Arrange and pay for appropriate means to achieve and document acceptable vibration velocity as specified herein.

B. Measurement Requirements:
   1. Measurements shall be taken on the bearing caps of the motor and driven equipment in the horizontal, vertical, and axial directions. If the bearings are concealed, the measurements shall be taken at the equipment mounting feet.
   2. The frequency range of testing must be broad enough to include all frequencies characteristic of the equipment, but shall in no case be less than 60 orders.
   3. Frequency filtering must be no greater than 10% of band width.
   4. Measurements must include velocity (inches/second peak to peak) and acceleration (inches/second) under a high band filter.
   5. Factory certification of vibration velocity of totally factory-assembled units will be acceptable in lieu of field measurements for packaged computer room-style air-conditioning units. If factory certification is not provided, then field vibration testing will be required.
C. Test Criteria:
   1. Maximum allowable vibration shall be in accordance with ISO-1940 Balance Quality Grades as follows:
      a. G16:
         1) Reciprocating engine generators.
         2) Reciprocating compressors.
      b. G6.3:
         1) Fans.
         2) Flywheels.
         3) Pumps (except turbine-driven pumps).
         4) Centrifugal and screw compressors.
         5) General machinery.
      c. G2.5: Turbine-driven pumps.
   2. If vibration exceeds the allowable maximum:
      a. Vibration Consultant:
         1) Identify source.
         2) Direct Contractor in applying appropriate vibration reduction correction.
      b. Contractor: Arrange and pay for appropriate means to achieve and document acceptable vibration.

3.2 VIBRATION TEST REPORT DATA

   A. General
      1. Agency name, address and telephone number and date of report submission.
      2. Project title, project number, Engineer and Contractor.

   B. Provide the following for equipment 10 horsepower (7.5 kW) and above:
      1. Diagrams showing measurement point locations and axes (horizontal, vertical, axial) for equipment tested.
      2. Bearing information for motors and driven equipment including:
         a. Location of bearings.
         b. Bearing identification.
         c. Bearing type.
         d. Number of balls per race.
         e. Fundamental train (cage) frequency.
         f. Ball spin frequency.
         g. Outer race frequency.
         h. Inner race frequency.
      3. Printed fast fourier transform (FFT) signatures of vibration amplitude versus frequency.
         a. For equipment not driven using variable frequency drives: At full speed.
         b. For equipment driven using variable frequency drives:
            1) At multiple operating speeds from minimum to maximum at equal intervals of 3 to 4 Hz VFD output. For example, a fan with a minimum VFD programmed output of 12 Hz and a maximum VFD programmed output of 60 Hz, must be tested at 12 and 60 Hz and also at all 3.2 Hz intervals between those 2 speeds.
         c. Include individual FFT signatures for each location, axis, and speed tested. For ease of reference show graphically on each signature the following “detect” frequencies:
            1) Cage.
            2) Ball spin.
            3) Outer race.
            4) Inner race.
            5) 2 times line.
            6) 1 times turn speed.
            7) Blade or vane pass.
         d. For each measurement location and axis, include a composite FFT signature showing all speeds tested.
      4. For equipment driven using variable frequency drives:
         a. Printed Bode’ start-up/coast down plots showing inches/second peak-to-peak and phase versus operating RPM. RPM range must be from VFD programmed minimum speed to VFD programmed maximum speed.
5. Test Results, Analysis and Discussion: For each motor, fan, pump, or other driven equipment:
   a. State whether the tested vibration amplitudes are or are not within specified limits.
   b. Identify bearing defects even if vibration amplitudes are within limits.
   c. Recommend acceptance or repair/replacement. In the case of repair, suggest repair steps.
   d. Identify all operating speeds within normal operating speed range that will cause resonant vibrations and should be avoided.

END OF SECTION 23 05 76
SECTION 23 05 93 – TESTING, ADJUSTING AND BALANCING 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 a description of the mechanical system testing, adjusting and balancing (TAB) scope of services. The following systems shall be included in the testing, adjusting, and balancing process:
   1. Hydronic distribution systems.
   2. Air handling/air distribution systems.
   3. Variable frequency drives.

B. Division of Work:
   1. In accordance with the General Conditions, Contractor shall be responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the work to be performed by specific trades.
   2. The following are suggestions as to how the Work may be divided. This is not a complete list of all the work:
      a. Mechanical Subcontractor:
         1) Provide related work as specified herein to support the mechanical systems TAB work being performed by TAB engineer.
         2) Provide access to all balancing devices.
         3) Provide replacement fan sheaves and impellers:
            a) At no additional cost to Owner.
            b) As required to achieve design performance for mechanical equipment.
         4) Perform system start-up functions including, but not necessarily limited to:
            a) Venting air from all hydronic system piping and components.
            b) Setting all manually operated dampers and valves in the full open position.
            c) Complete and submit pre-test and balance checklist to Engineer and TAB engineer prior to start of TAB work.
         5) Correct all mechanical system deficiencies identified by TAB engineer.
      b. TAB Engineer:
         1) Provide timely notice to mechanical Subcontractor, TCS Subcontractor and Commissioning Authority of all incomplete work and deficiencies which prevent proper performance of test and balance work.
         2) Test, adjust and balance all air and hydronic systems and prepare final report.
      c. Temperature Control System (TCS) Subcontractor:
         1) Provide related work as specified herein to support the mechanical systems TAB work being performed by TAB engineer.
         2) Operate all temperature control devices to support TAB work that is dependent on various control operating modes.
         3) Correct all TCS system deficiencies identified by TAB engineer.
      d. Commissioning Authority: Provide verification of system function in conformance with design intent, including systems balance and adjustment, and controls function.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. Sheet Metal and Air Conditioning Contractor’s Association (SMACNA) publications:
      a. Procedural Standards for Testing, Adjusting, and Balancing of environmental systems.

1.4 DEFINITIONS

A. Proper Performance Characteristics:
   1. In accordance with design intent, acceptable energy efficiency and Manufacturer's recommendations.
   2. Providing acceptable thermal and acoustical performance in all service areas.
   3. As directed by Engineer.

B. TAB Engineer: An individual, firm or corporation whose primary work is testing, adjusting and balancing environmental systems working under a direct contract to the Contractor.

1.5 SUBMITTALS

A. Submit Pre-Test and Balance Checklist and mechanical systems TAB report in accordance with Division 01 Section "Submittal Procedures."

B. Submit Pre-Test and Balance Checklist at least 2 weeks prior to scheduled start of TAB work as scheduled by Contractor and approved by Owner.

C. Preliminary TAB Submittal:
   1. Prior to final inspection.
   2. 1 copy to Engineer.
   3. 1 copy to mechanical commissioning authority: As soon as possible after balancing work to facilitate spotchecking.

D. Final Submittal: 1 copy to Engineer.

E. The TAB report shall include, but not necessarily be limited to, the following general items:
   1. Summary remarks regarding problems.
   2. Initial, interim and final performance test data.
   3. Description of test procedures and equipment used.
   4. Systems' Drawings and/or schematics clearly marked to identify location of equipment tested, duct traverse location(s), location of system static pressure sensor, etc.
   5. Systems performance data sheets shall include design conditions, installed equipment information, and field test data for:
      a. Air Systems:
         1) Design Conditions:
            a) Air capacity.
            b) System total static pressure drops and profiles of all air handling systems, including filters, coils, etc.
            c) Motor horsepowers and design brake horsepowers.
            d) Fan speeds.
            e) Fan curves or fan rating tables showing design conditions.
         2) Installed Equipment:
            a) Equipment Manufacturer.
            b) Equipment model numbers, sizes, types, etc.
            c) Motor types, sizes and characteristics.
            d) Heater and starter types, sizes and characteristics.
            e) Drive types, sizes and speed range.
            f) Equipment ratings if different from design.
            g) Identification of all terminal devices, including outlets.
            h) Location of all smoke control devices.
      3) Field Test Data - Initial and Final Test Readings For:
         a) Air capacities.
         b) Static pressures through units and unit components.
         c) Equipment speeds.
         d) Motor operating voltages and amperages.
e) Brake horsepower.
f) Operating performance plotted on fan curves or fan rating tables.
g) System schematic and notes including measured static pressure values, system static pressure sensor values, etc.
h) Airflow and static pressure data for all duct mains as balanced under typical total system operation. Report will not be accepted without airflow and static pressure profile (refer to Paragraph 3.3).
i) Identify each outlet or inlet as to location, area, size and fan system.
j) Required and field measured cfm for each outlet or inlet.
k) Identify each smoke control device and pressure differential and flow test data.

b. Hydronic Systems:
1) Design Conditions:
   a) Water flow rates.
   b) Pump TDH and speed.
   c) Motor horsepowers and design brake horsepowers.
   d) Pressure drops through coils, heat exchangers, etc.
   e) Pump curves showing design conditions.
2) Installed Equipment:
   a) Equipment Manufacturer(s).
   b) Equipment model numbers, sizes, types, etc.
   c) Motor types, sizes and characteristics.
   d) Heater and starter types, sizes and characteristics.
   e) Equipment ratings if different than design.
3) Field Test Data - Initial and Final Test Reading For:
   a) Pump pressures at full flow and at shut-off.
   b) Pump motor operating voltages and amperages.
   c) Flow rates through all flow indicators.
   d) Positions of balancing valves.
   e) Inlet pressure, outlet pressure and pressure drops through all heating (and cooling) equipment pieces.
   f) Brake horsepower.
   g) Operating performance plotted on pump curves.

1.6 QUALITY ASSURANCE

A. Qualifications:
1. TAB Field Technician Personnel:
   a. Trained and experienced in the operation of the test and balance equipment.
   b. Knowledgeable of the design of all systems scheduled for testing and balancing.
2. TAB Engineer:
   a. A certified member of either the following organizations:
      1) AABC.
      2) NEBB.
   b. Acceptable firms providing testing, adjusting, and balancing services include:
      1) Absolute Balancing Company, South Lyon, Michigan.
      2) International Test & Balance, Southfield, Michigan.
      3) Total Balance Company, St. Claire Shores, Michigan.
      4)...

B. Report Forms:
1. The report forms included in the appendix of the AABC Standard are incorporated in the work of this Section for the purpose of identifying the level of detail required for testing and reporting.
2. TAB engineer may use the AABC forms or other similar forms which present equivalent information in a logical format.
PART 2 - PRODUCTS

2.1 MATERIALS

A. Patching Materials:
   1. Comply with requirements as specified in other Sections where applicable to provide materials essentially and functionally identical to original installation before testing and balancing work.
   2. Maintain the integrity of systems for air tightness, water tightness, and durability of finish.

2.2 INSTRUMENTS

A. Instruments used for TAB work shall be as indicated in the referenced standards.

B. Calibration:
   1. Instruments to have been calibrated within one year of start of TAB work.
   2. Appropriate documentation shall be made available to the Engineer on request.

PART 3 - EXECUTION

3.1 PROCEDURES

A. General:
   1. Determine what actual performance characteristics are deemed proper during system tests.
   2. If the design supply, return or exhaust air quantities for a space create a space pressure other than neutral, or if a space is indicated to be a certain pressure, provide balancing to the extent required to achieve this designed pressure.
   3. During heating (and cooling) season of the first year of operation, at times when directed, make final adjustments until all occupants are reasonably satisfied and all equipment is operating at peak efficiency.
   4. Confirmation of proper equipment operation must be through actual observation. Computer simulation and sensor readouts are not acceptable proof.

B. Air Systems:
   1. General:
      a. Adjust and set all dampers, deflecting vanes, discharge vanes and accessory items to achieve proper air distribution and patterns in all parts of the air supply, return and exhaust systems:
         1) Determine air flow and static pressure in all branch ducts by velocity traverse and balance out all branches by means of branch duct manual dampers.
         2) Balance terminal outlets on each branch duct using volume dampers in run-out duct to the outlet, not the terminal outlet dampers.
      b. Mark final balance position for all dampers which are not left 100% open with an indelible pen.
      c. Adjust and set all belted fan speeds as required to attain proper total air flow.
      d. Measure supply fan total air flow at both the full return air and full outdoor air damper positions.
      e. Make smoke gun tests, if necessary, to check for drafts and make final adjustments and settings for optimum comfort conditions.
   2. Methods: Acceptable procedures for obtaining performance measurements are listed below:
      a. CFM Airflow for Duct Sections:
         1) Duct traverse as specified in SMACNA Manual "HVAC Systems - Testing, Adjusting and Balancing," Chapter V, Section 4-B, using a pitot tube and inclined manometer.
         2) Acceptable Methods:
            a) Pitot tube array with reading by inclined manometer.
            b) Electronic manometer.
            c) Hot-wire anemometer.
      b. CFM airflow, for room supply, return and exhaust, at diffusers, registers and grilles: Use airflow hood.
      c. Fan TSP: Use inclined manometer.
      d. Equipment Pressure Drops: Use inclined manometer.
      e. Air Temperatures: Use thermometer.
      f. Smoke Testing: Use a non-hazardous material.
3. TAB Procedures for Air Systems:
   a. Check all motorized, balancing and gravity relief dampers for proper position.
   b. Inspect coils, filters and fans for cleanliness.
   c. "Bump" motor to check for proper fan rotation.
   d. Check unit performance including:
      1) Fan speed.
      2) Amperage and voltage.
      3) Suction, discharge and total static pressures at fan.
      4) Supply air volume of fan by taking duct traverse in discharge duct or zone ducts.
   e. Note: Check unit performance in both 100% outside air and 100% return air positions, including static pressures across individual equipment components.
   f. Set outside air motorized damper at proper minimum position.
   g. See that necessary adjustments or changes are made to achieve design airflow capacities or consult Engineer if change(s) required are beyond the scope of the TAB contract.
   h. Balance Medium and High Velocity Ductwork:
      1) Measure inlet static pressure and airflow at all terminal unit inlets through actual transverse. Flow sensor readings are not acceptable.
      2) If terminal unit has constant volume regulator or manual adjustment damper, make certain the correct maximum amount of air is being delivered.
      3) All measurements should be taken only when system is operating under normal operating conditions.
      4) If system is variable volume, set up diversity conditions where applicable and record static pressure at sensor(s).
      5) Set terminal unit minimum airflow capacities where applicable.
   i. Balance Low Velocity Ductwork:
      1) Take traverse and static pressure readings in main branch ducts and set balancing dampers for approximate correct distribution of air.
      2) Proportionately balance all branch ducts.
      3) Proportionately balance all outlets and inlets.
      4) Make smoke gun tests to check for drafts and make final settings for optimum comfort conditions in occupied space.
      5) Recheck supply air unit performance and make any necessary final adjustments. Include allowances for wet coil, dirty filters, and other normal operating conditions which may reduce air flow.
      6) Record final measurements as required.

C. TAB Procedures for Water Systems:
   1. Adjust and set all applicable balancing valves to achieve proper water distribution to all components of the hydronic heating and cooling systems.
   2. When valves are in final balance position, permanently mark by placing a punch mark or a scratch mark or by drilling a hole in body of valve and setting memory ring where applicable.
   3. Verify pump performance by means of system flow meter and/or pump head measurements in conjunction with shutoff head measurement.
   4. Proportionally set all primary cross-over bridge circuits. Set 3-way valve for full flow through bridge, bypassing the secondary circuit, and measure flow by means of bridge flow meter.
   5. Remeasure pump delivery after system is proportionally balanced.
   6. Test and balance secondary pumping circuits as required by system type.
   7. Immediately after system balance, report pump throttling required to Engineer.

3.2 FIELD QUALITY CONTROL

A. Preliminary Review and Analysis:
   1. If after standard balancing procedures have been carried out and readjustments attempted, the system does not perform as specified, Engineer shall be notified at once.
   2. All "as is" field data shall be submitted in a preliminary report for review and analysis.
3. Manipulation of system to achieve air flow and balance without meeting intended and specified total system air flow will not be accepted in a balance report. Should this occur, rebalance shall be at the Contractor's expense.

B. Final Inspection: Prior to final acceptance, all systems shall be operated to test performance as directed to the satisfaction of the Engineer:
   1. Steam and water shall circulate throughout entire system without noise, evidence of leaks and trapping or air-binding.
   2. Air in ducts shall circulate without excessive noise.
   3. Motors, fans and other equipment shall operate without excessive noise or vibration.
   4. Systems shall be balanced to operate within stated tolerances. If any heating unit, chilled water cooling coil, or air outlet does not operate within the stated tolerances, then the entire system shall be considered out of balance and shall be readjusted until all units are within the stated tolerances.
   5. Heating, ventilating and air-conditioning systems shall maintain uniform temperatures without drafts.
   6. Burners shall be tested and set for high efficiency and smokeless combustion.

C. Testing:
   1. TAB engineer shall coordinate with Commissioning Authority to schedule access to site to perform air and hydronic system testing to whatever extent Commissioning Authority determines is necessary to verify accuracy of mechanical systems TAB report.
   2. TAB engineer will repeat system testing, adjusting, and balancing until Engineer verifies accuracy of data.

3.3 STATIC PRESSURE AND AIR FLOW PROFILE

A. Provide a static pressure and air flow profile diagram similar to Exhibit A attached:
   1. Air flow readings shall be based on a duct traverse.
   2. Data shall reflect actual coincident system performance established at total system balance:
      a. Throttling of one branch below design to obtain design performance in another is not acceptable. Refer to Paragraph 3.2.A.
      b. Diversity in variable air volume systems shall be reflected on profile diagram.
   3. Provide data for each duct main and a minimum of one set of readings for each floor for multiple floor systems.

3.4 PRE TEST AND BALANCE CHECKLIST

A. Contractor shall copy the following Pre Test and Balance Checklist (Exhibit B, attached) and submit one completed checklist for each AHU, pump, chiller, boiler, cooling tower, fan, cabinet heater, and unit heater.

B. TAB engineer may be entitled to be compensated for additional time required due to failure of other Subcontractors to properly complete their work.
SCHEMATIC AND NOTES:
STATIC PRESSURE AT MAXIMUM OUTSIDE AIR/MINIMUM OUTSIDE AIR

RETURN AIR

RETURN AIR

12" BOX FILTER

DX COOLING COIL

FAN

HOT WATER HEATING COIL

-1.34/-1.4

-2.05/-1.93

-2.51/-2.44

+1.6/+1.72

+1.52/+1.65

STATIC PRESSURE

SUPPLY PLENUM

ROOF

SUPPLY DUCTS

3RD FLOOR

STATIC PRESSURE, CFM (TYPICAL)

2ND FLOOR

1ST FLOOR

STATIC PRESSURE PROFILE AT FINAL BALANCED CONDITIONS
NO SCALE

EXHIBIT A
EXHIBIT B  
PRE TEST AND BALANCE CHECKLIST

Equipment Tag No. ___________________ Date: ___________________

As an aid to properly interface work between trades and prevent unnecessary return visits for everyone concerned, the TAB engineer requires that the following list of items be completed by the Mechanical Subcontractor prior to any testing and balancing of air and hydronic systems.

Work required is as follows:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Static pressure control sensors shall be installed in locations indicated on contract documents.</td>
</tr>
<tr>
<td>2.</td>
<td>Variable frequency controllers installed on fan drives shall be properly set up for minimum to maximum speed positions.</td>
</tr>
<tr>
<td>3.</td>
<td>Fan rotation is correct.</td>
</tr>
<tr>
<td>4.</td>
<td>Fan RPM is to be set after fan performance test by Test and Balance Contractor, however, initial installed RPM shall be within 10 percent of what was intended per equipment submittal.</td>
</tr>
<tr>
<td>5.</td>
<td>Verify that fan is running within motor nameplate amp draw at initial installed RPM.</td>
</tr>
<tr>
<td>6.</td>
<td>Balancing dampers shall be installed in locations shown on Contract Documents.</td>
</tr>
<tr>
<td>7.</td>
<td>Damper operators shall be installed with provisions for access and not covered with insulation.</td>
</tr>
<tr>
<td>8.</td>
<td>All (normal operational) dampers shall be set and locked in the 100 percent open position.</td>
</tr>
<tr>
<td>9.</td>
<td>All fire dampers shall be open with fuse links installed and any props removed. Any motor operated fire and smoke dampers are operating correctly.</td>
</tr>
<tr>
<td>10.</td>
<td>All filters shall be in place, including clean construction filters installed upstream.</td>
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<tr>
<td>11.</td>
<td>Terminal units shall be functioning with thermostat.</td>
</tr>
<tr>
<td>12.</td>
<td>Terminal units shall be sequencing properly with radiation valve (i.e., normally closed T.U. with normally open valve, etc.).</td>
</tr>
<tr>
<td>13.</td>
<td>Reverse acting (R.A.) thermostat shall be with N.O. terminal boxes and direct acting (D.A.) thermostat shall be with N.C. terminal boxes.</td>
</tr>
<tr>
<td>14.</td>
<td>All air shall be bled from hot or chilled water system.</td>
</tr>
<tr>
<td>15.</td>
<td>All (normal operational) valves shall be set in 100 percent open position.</td>
</tr>
<tr>
<td>16.</td>
<td>Memory devices shall be installed on all specified balancing valves.</td>
</tr>
<tr>
<td>17.</td>
<td>Installation of all temperature wells and gage cocks.</td>
</tr>
<tr>
<td>18.</td>
<td>Pressure taps shall be installed across body of pump and inlet and outlet of coils. Location of pressure taps shall be between isolation and check valves, etc., associated with coils.</td>
</tr>
<tr>
<td>19.</td>
<td>Hydronic systems shall have been cleaned and flushed and construction strainers removed from equipment.</td>
</tr>
<tr>
<td>20.</td>
<td>Pump rotation shall be correct.</td>
</tr>
<tr>
<td>21.</td>
<td>Verify that pump is running within motor nameplate amp draw at initial installed impeller size.</td>
</tr>
<tr>
<td>22.</td>
<td>All exhaust fans shall be wired, operable and in correct rotation.</td>
</tr>
<tr>
<td>23.</td>
<td>All multiple exhaust duct system balance dampers shall be installed and set 100 percent open.</td>
</tr>
<tr>
<td>24.</td>
<td>All relief air or backdraft dampers shall be set for proper operation, i.e., just closing.</td>
</tr>
</tbody>
</table>

END OF SECTION 23 05 93
SECTION 23 07 13 – DUCT INSULATION

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 furnishing and installation of thermal insulation applied to external surfaces of ductwork and air handling devices.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:

1. ASTM Specifications:
   c. C612 – Mineral Fiber Block and Board Thermal Insulation.

2. NFPA Standard:
   a. 90A - Installation of Air Conditioning and Ventilating Systems.


5. Underwriter’s Laboratories:
   b. UL-181 – Factory-Made Air Ducts and Air Connectors.

1.4 SUBMITTALS

A. Manufacturer's Literature: For all thermal materials.
   1. Manufacturer product data brochure.
   2. Thermal performance characteristics - "K" Values.
   3. Details of construction and installation.
   4. Compliance with standards and UL listing.

B. Samples:
   1. Proposed substitutions for products other than those herein specified.
   2. Engineer's approval prior to installation.
   3. Fire barrier shall have the following ratings:
      a. Flame Spread Maximum: 0.
      b. Smoke Developed Maximum: 0.
      c. In accordance with ASTM E84.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.
B. Regulatory Agencies Requirements:
   1. State and local codes and ordinances.
   2. Insulation, facing and adhesive shall have a composite rating:
      a. 25 flame spread maximum.
      b. 50 smoke developed maximum.
      c. In accordance with NFPA 255.
   3. Fire barrier shall have the following ratings:
      a. 0 flame spread maximum.
      b. 0 smoke developed maximum.
      c. In accordance with ASTM E84.

1.6 DELIVERY, STORAGE AND HANDLING

A. Materials shall be delivered in original, unbroken, brand marked containers.

B. Handle and store materials in a dry place in a manner which will prevent deterioration and contamination with foreign matter.

C. Reject damaged, deteriorated, contaminated material, or showing evidence of moisture, and immediately remove from the Site. Replace removed materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Thermal Insulation:
   1. Owens-Corning.
   2. Johns Manville.
   3. Armacell.
   5. Rubatex.

B. Adhesives:
   1. Benjamin-Foster.
   2. Baldwin-Ehret-Hill.
   3. Childers.
   4. Foster.
   5. Armstrong.

2.2 MATERIALS

A. Rigid Fiberglass Board (R):
   1. Glass fibers bonded into rigid rectangular panels.
   3. Thickness: As scheduled.
   4. Thermal Conductivity (k): 0.22 BTU-in/hr-sf - F degrees at 75 degrees mean.
   5. Facing: All service jacket (ASJ).
   6. Owens-Corning, #705; or equal

B. Flexible Duct Wrap (F):
   1. Glass fiber blanket, factory-laminated to vapor barrier facing.
   2. Density: 1.00 lbs/cu ft.
   3. Thickness: As scheduled.
   4. Thermal Conductivity (k): 0.30 at 75 degrees mean.
   5. Facing: FSK.
   6. Owens-Corning, Type 75; or equal.
C. High Density Flexible Duct Wrap (F-HD):
   1. Glass fiber blanket, factory-laminated to vapor barrier facing.
   2. Density: 1.50 lbs/cu ft.
   3. Thickness: As scheduled.
   4. Thermal Conductivity (k): 0.25 at 75 degrees mean.
   5. Facing: FSK.
   6. Owens-Corning, Type 150; or equal.

2.3 COVERING

A. Canvas Jacket (C):
   1. 8-ounce canvas applied between 2 coats of Foster 30-36 or Childers CP-50AMV-1 white lagging adhesive.
   2. Paint in compliance with the requirements of Division 09 Section “Painting,” color as selected by Engineer.

2.4 MECHANICAL FASTENERS

A. Impale Anchor:
   1. 12-gage galvanized steel.
   2. With self-adhesive pad.
   3. 2-inch speed washer.

2.5 ADHESIVES

A. Insulation-Adhesive and Tape: As recommended by Manufacturer of insulation.

B. Canvas Adhesive: Foster 30-36, Childers CP-50 AMV-1; or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean ductwork surfaces prior to applying insulation.

3.2 INSTALLATION

A. Follow insulation Manufacturer's recommended procedures.

B. Thermal Insulation:
   1. Rigid insulation shall be attached with mechanical fasteners spaced no more than 16 inches center-to-center and no more than 3 inches from ductwork edges or insulation joints.
   2. Flexible wrap insulation shall be attached with 4-inch wide strips of insulation bonding adhesive spaced at 8 inches center-to-center. Adhesive shall be applied over entire surface of ductwork conveying or subjected to unconditioned outside air.
   3. Mechanical fasteners shall also be used on the underside of rectangular ductwork runs wider than 24 inches. Fastener spacing in accordance with A. above.
   4. Allow maximum fullness at corners when using flexible wrap.
   5. Provide removable section of insulation with a protected edge over access doors and around damper operators to allow operation without damage to insulation.

C. Joints and Sealants:
   1. Joints shall be tightly butted and sealed with 3-inch (minimum) foil reinforced kraft tape. Fastener penetrations and any other punctures in the vapor barrier facing shall also be taped and sealed with vapor barrier adhesive. Seams, penetrations, and punctures shall also be vapor sealed with a 4-inch wide coating of vapor barrier mastic.
   2. Flexible wrap insulation joints shall be made with a 2-inch overlap of the vapor barrier secured with 9/16-inch outward clinching staples spaced 6 inches center-to-center.
3. Taped joints at patches on rigid insulation shall be burnished or ironed on to ensure a tight seal.
4. Use double tape strips when joining faced with unfaced insulation.

D. Damper Handles:
1. Seal all exposed edges of insulation around handles.
2. Tie a 2-foot long piece of bright orange ribbon on handle so it hangs down allowing easier visual locating of dampers.

3.3 APPLICATION SCHEDULE

A. Insulation Material Type:
   - R = Rigid fiberglass board
   - F = Flexible duct wrap
   - F-HD= High density flexible duct wrap
   - L = Internal liner – Refer to Division 23 Section “Sound and Vibration Control for HVAC” for requirements

B. Covering (Refer to Part 2, Paragraph 2.3, of this Specification Section):
   - C = Canvas jacket

C. Flanged Ductwork: Insulation thickness indicated shall be increased to be at least a 1/2-inch thicker than the flange depth.

D. Definitions:
   1. Concealed: A space concealed from view or otherwise accessible only through the removal of ceiling tiles, access panels, or building construction components.
   2. Exposed: Not concealed.
   3. Plenum: A ceiling plenum or other concealed space used to transport air.
   4. Heated Space: A space with a direct supply of heating.
   5. Warm Space: A space within the building thermal barrier and also within the building vapor barrier but not having a direct supply of heating.
   6. Unheated Space: A space within the building but outside of either the building thermal barrier or the building vapor barrier.
   7. Cooled Space: A space with a direct supply of cooling.
   8. Outside Air and Mixed Air: Unconditioned outside air, partial outside air, or relief or exhaust air downstream of last damper and subjected to unconditioned outside air.

E. Supply and Return Air:
   1. Concealed:
   2. Exposed – Rectangular:
      a. In Mechanical Spaces: Type R, 2-inch, Type C covering.
   3. Exposed – Round and Flat Oval:
      a. In Unheated or Warm Space: Type F-HD, 2-inch, Type C covering.

F. Exhaust Air From a Cooled Space:
   1. Concealed in all spaces that are outside of the building or space vapor barrier: Type F, 2-inch.
   2. Exposed in a space outside of the building or space vapor barrier:
      a. Rectangular: Type R, 2-inch.
      b. Round or Flat Oval: Type F-HD, 2-inch, Type C covering.

G. Outside or Mixed Air:
   1. Exposed – Rectangular:
      a. In Mechanical Space: Type R, 2-inch, Type C covering.
H. Internal Duct Liner:
   1. Where indicated on Drawings, Contractor will use internal acoustic duct liner (Type L), in lieu of insulation specified above. Covering is not required.
      a. Refer to Division 23 Section “Sound and Vibration Control for HVAC” for acoustic duct liner requirements.

END OF SECTION 23 07 13
SECTION 23 07 19 – HVAC PIPING INSULATION

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 furnishing and installation of piping insulation.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
1. ASTM Specifications:
   b. C533 - Calcium Silicate Block and Pipe Thermal Insulation.
   c. C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
   e. C552 - Cellular Glass Block and Pipe Thermal Insulation.

1.4 SUBMITTALS

A. Manufacturer's Literature:  For piping insulation.
1. For Each Type Used:
   a. Name of Manufacturer.
   b. Details of construction and installation.
   c. Manufacturer's data (density, K-factor).
2. For Each Application:
   a. Thickness.
   b. Total "R" value.
   c. Jacket material.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
1. Trained and experienced in the fabrication and installation of the materials and equipment.
2. Knowledgeable of the design and the reviewed Shop Drawings.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unbroken, brand marked containers or wrapping as applicable. Handle and store materials in a manner which will prevent deterioration and contamination with foreign matter.
B. Reject damaged, deteriorated, or contaminated material and immediately remove from the Site. Replace removed materials at no additional cost to Owner.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Insulation:
   1. Pittsburgh-Corning.
   2. Owens-Corning.
   3. Certainteed.
   4. Armacell.
   5. Rubatex.

B. Adhesives:
   1. Foster.
   2. Childers.
   3. Vimasco.
   4. B.E.H.
   5. Or approved equal.

2.2 TYPES OF INSULATION MATERIALS

A. Rigid Molded Glass Fiber – General (FG):
   1. All-service jacket (ASJ) type factory applied jacketing.
   2. 3 lbs/cu ft minimum density.
   3. k factor of 0.23 at 75 degrees F mean.
   4. 50 degree F service temperature.
   5. Owens-Corning Type ASJ Max Pipe Insulation with SSL Max closure system; or equal.
   6. Typical for application on pipes 16 inches and up.

B. Mineral-Fiber Insulation (MF):
   a. Type I, 850 Degrees F (454 Degrees C) Materials:
      1) Mineral or glass fibers bonded with a thermosetting resin.
      2) Comply with ASTM C547, Type I.
      3) All-service jacket (ASJ) type factory applied jacketing.
   b. Johns Manville "Micro-Lok;" or equal.

   2. Pipe and Tank Insulation:
      a. Mineral or glass fibers bonded with a thermosetting resin.
      b. Semirigid board material complying with ASTM C1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C612, Type IB.
      c. Nominal density is 2.5 lb./cu. ft. (40 kg/cu. M) or more.
      d. Thermal conductivity (k-value) at 100 degrees F (55 degrees C) is 0.29 BTU x in./h x sq. ft. x degrees F (0.042 W/m x K) or less.
      e. All-purpose jacket (AP) type factory applied jacketing
      f. Johns Manville; MicroFlex; or equal.

2.3 INSULATION INSERTS

A. Insulation inserts shall be made of calcium silicate treated with water repellant.

B. Inserts shall be preformed for the pipe size, same thickness as adjoining pipe insulation, same length as shield, and 180 degree-minimum segments.
C. Insulation inserts shall not be less than the following lengths:
1. 2-1/2-Inch Pipe Size and Less: 10 inches long.
2. 3-Inch to 6-Inch Pipe Size: 12 inches long.
3. 8-Inch to 10-Inch Pipe Size: 16 inches long.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Install piping insulation:
   a. In conformance with the Drawings, these Specifications, and the Manufacturer's recommendations.
   b. Over clean, dry piping system.
   c. To the following thickness:
      1) As specified herein or as indicated on the Drawings.
      2) If not specified herein or indicated on the Drawings, in accordance with Manufacturer's recommendations for the specific application.
   d. Continuous through walls, ceilings and sleeves except at fire stops.
2. Fill all cracks and voids with insulating cement carefully troweled to leave a smooth finish.
3. Repair or replace insulation damaged by:
   a. Demolition.
   b. Making connections to piping or equipment.
   c. Water or mildew.
4. Verify that piping has been tested and cycled before applying insulation materials.
5. All sectional pipe covering shall be neatly and tightly applied with unbroken lengths and with the ends of the sections firmly butted together. Longitudinal joints shall be on the least conspicuous side of the pipe and slightly staggered. fiberglass cloth or other coating shall be lapped over all joints and well pasted or cemented down in a neat and inconspicuous manner.
6. The insulation on piping shall be extended through all sleeves, anchor points and supports in order to produce a continuous application, and same shall be installed to conform to a uniform diameter.
7. All fittings, flanges, end caps, etc. on all lines, except where otherwise noted, shall be covered with insulated fitting covers. Thickness of insulation, jackets and finishes shall also match adjacent piping.
8. Insulation for piping shall be continuous through hangers and supports.
9. Provide insulation inserts and insulation protection shields at hanger or support locations. Valve bodies to the bonnet flange or union, drip legs, and pipes at anchor points shall be insulated. Terminate insulation into a finished end.
10. Steam traps shall not be insulated.
11. Terminate insulation into a finished end.

B. Joints and Fittings:
1. Block insulate valves and flanges with reusable insulation system.
2. Insulate elbows, tube turns, sweeps and bends with mitered sections or premolded fittings. Match pipe covering material where used.
3. Fit joints tightly together.
4. Seal joints with sealing compound and preformed aluminum bands.

3.2 PIPING INSULATION APPLICATION SCHEDULE

A. Basis of Thickness Chart:
1. Thicknesses shown are based on products having a maximum "k" factor of 0.26 at a mean temperature of 75 degrees F.
2. These Thicknesses:
   a. Can be reduced for products having significantly lower "k" values.
   b. Shall be increased for products having higher "k" values in order to produce equivalent or greater thermal resistance.
B. Flame/Smoke Ratings: Local requirements for flame and smoke ratings must be met and may exclude some options listed herein.

C. Thickness Chart (In Inches):
   1. Key: Insulation Type (Refer to Paragraph 2.2 of this Section):
      a. FG = Rigid Fiberglass.
      b. MF = Mineral Fiber.

<table>
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<th>PIPE SIZE</th>
<th>Piping Systems Type</th>
<th>Temp (F) Range</th>
<th>Less Than 1&quot;</th>
<th>1&quot; to 1-1/4&quot;</th>
<th>1-1/2&quot; to 3&quot;</th>
<th>4&quot; to 6&quot;</th>
<th>8&quot; &amp; Up</th>
<th>Type of Insulation *</th>
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<td>1.5</td>
<td>2.5</td>
<td>3.0</td>
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<td>FG</td>
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</table>

* See PART 2 – PRODUCTS Article 2.2 TYPES for types of insulation.

END OF SECTION 23 07 19
SECTION 23 08 00 – COMMISSIONING OF 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 lists mechanical systems to be commissioned.

1.3 SYSTEMS TO BE COMMISSIONED

A. The following systems will be commissioned:

1. Heating Water Systems:
   a. Piping.
   b. Pumps.
   c. Heat exchangers.

2. Cooling Water Systems:
   a. Piping.
   b. Pumps.

3. Air Handling Systems:
   a. Air handling units.
   b. Return and exhaust fans.
   c. Ductwork.
   d. Room temperature controls.
   e. VAV terminals.

   a. Operator Interface functions, graphics and webpages.
   b. Actuators.
   c. Controls sensors.
   d. Control valves and dampers.
   e. Other miscellaneous alarms.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION 23 08 00
SECTION 23 09 00 – INSTRUMENTATION AND CONTROL 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 the design, furnishing and installation of HVAC instrumentation and controls (HI&C) systems:
   1. The Work of this Section also includes the integration of the Work of other trades as necessary to provide a complete operational control system as defined in the Contract Documents.

B. Major items unique to the work of this Section:
   1. Direct digital control (DDC) hardware.
   2. DDC software.
   3. All remote sensing devices and interconnecting wiring or tubing.
   4. All secondary control devices including, but not necessarily limited to, the following:
      a. Thermostats and humidistats.
      b. Temperature and humidity sensors.
      c. Primary and secondary controllers.
      d. Automatic valves and dampers.
      e. Damper and valve operators.
      f. Relays.
      g. Control panels.
      h. Operator interface.
      i. Network devices.
      j. Miscellaneous sensors.
   5. Electric power supply source.
   6. Conductor and conduit.
   7. Necessary appurtenances to make a complete and functional system to satisfy the functional intent.
   8. Final and complete operational demonstration.
   9. BMS/SCADA interface, integration devices and programming.

C. Mechanical systems included in the Work of this Section:
   1. Except as specifically described below, it is the work of this Section to provide, install and integrate complete control of the HVAC systems, including, but not limited to the following:
      a. Primary heating
      b. Condensing water system controls.
      c. Air handling unit controls.
      d. Terminal unit controls.
      e. Ventilation system controls.

D. Integration:
   1. Provide communication interface and network integration for the following packaged control systems furnished under the Work of other Sections:
      a. Package HVAC units as specified in Division 23 Section “Packaged, Indoor Heating and Cooling Units.”
      b. Variable air volume boxes as specified in Division 23 Section “Air Terminal Units.”
      c. Smoke detectors in ductwork and air handling units.
   2. Existing Control Equipment:
      a. Provide for interface between new controls installation and Owner’s existing control and building management systems:
         1) As required to satisfy the functional intent description of this Section.
      b. All existing equipment is assumed to be fully functional and in proper working order as it relates to the work of this Section for Base Bid.
1.3 DIVISION OF WORK

A. In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the work to be performed by specific trades.

B. The following are suggestions as to how the Work may be divided. This is not intended to be a complete list of all the Work:

1. Mechanical Subcontractor:
   a. Install automatic valves and separable wells that are specified to be supplied by HI&C Subcontractor.
   b. Provide all necessary valved pressure taps, steam, water drain and overflow connections and piping.
   c. Provide all necessary piping connections required for flow devices, valve position indicators, flow switches, etc.
   d. Install all automatic dampers unless furnished as a factory mounted item with HVAC equipment.
   e. Provide all necessary blank-off plates (safing) required to install dampers that are smaller than duct size.
   f. Assemble multiple section dampers with the required interconnecting linkages and extend required number of shafts through ductwork for external mounting of damper motors.
   g. Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation and seal permanently in place only after all stratification problems have been eliminated.
   h. Provide access doors or other approved means of access through ducts for service to control equipment.
   i. Mount duct smoke detectors.

2. Electrical Subcontractor:
   a. Provide conduit, conductors, and wire for all 120 volt or higher devices which interlock equipment provided under Division 23 with equipment and devices provided under other Divisions of the Specifications as indicated on Electrical Drawings and Division 26 Specifications.
   b. Provide power to DDC panels as indicated on the Drawings.
   c. Furnish smoke detectors.
   d. Furnish power and control wiring of duct smoke detectors. Termination by HI&C Subcontractor.
   e. Provide devices, conduit and wiring as indicated on Electrical Drawings.

3. HI&C Subcontractor:
   a. Be responsible for controls systems operation in accordance with sequence of operations description defined in Division 23 Section “Sequences of Operation for HVAC.”
   b. Furnish all automatic dampers, valves, operators and linkages.
   c. Provide a detailed schedule for the Mechanical Subcontractor of all automatic dampers and valves requiring their assembly or installation as suggested above.
   d. Provide 120 volt and low voltage power to all valve/damper motors requiring same.
   e. Wire all 120 volt flow, pressure and temperature sensing devices.
   f. Coordinate with Electrical Subcontractor for smoke detector interface compatibility and functional intent.
   g. Make final terminations to controlled components, including terminations from smoke detectors.
   h. Provide conductors and conduit, including low voltage and 120 volt, as required to provide functional intent, except as specifically indicated otherwise on Drawings or in the specifications.
   i. Provide all interface devices necessary for required communication to other systems.
   j. Provide for power supply for all DDC panels that are required that are in addition to those indicated on the Drawings.
   k. Support Commissioning Authority in functional performance testing in accordance with the requirements of Division 23 Section “Commissioning of HVAC.”
   l. Provide certification to Commissioning Authority of complete control system function and calibration.

4. Commissioning Authority (CxA): Provide verification of system function in conformance with design intent, including selected sensor calibration.
1.4 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the Work of this Section shall comply with the following:

1. ANSI - American National Standards Institute:
   b. ANSI X3.4 (ASCII).

2. EIA - Electronic Industry Association: EIA Standard RS-232-C.

3. NFPA – National Fire Protection Association:
   a. 70 – National Electrical Code.

1.5 DEFINITIONS

A. Where applicable, the terminology used herein uses the definitions listed in ASHRAE Standard 13.

B. Other definitions used include:

1. Low Voltage:
   a. Voltage less than 120V single phase, typically 24V AC.
   b. Low voltage is used primarily for communication and control of devices.

2. Large Valves: Valves for piping greater than 2 inches in diameter.

3. Large Dampers: Greater than 133-inch/pound torque required or 30 square feet.

4. DDC: Direct digital controls.

5. IP: Internet protocol.

6. LAN: Local area network.

7. HVAC: Heating, ventilating and air conditioning systems. Generally, the work of Division 23.

8. Primary Controller: A device that includes IP to field bus router, automatic time scheduling, trend logging, alarm handling, and supervisory logic control functionality. Sometimes referred to as a Building Controller.

9. Secondary Controller:
   a. Advanced Application Controller: A controller with provisions and the control logic for all of the physical inputs and physical outputs associated with a single mechanical component such as a terminal unit, air-handling unit, chiller or boiler. An Advanced Application Controller may or may not have data management features such as time schedules, trend data storage and alarm message generation capabilities. These features may be provided by the Building Controller.
   b. Application Specific Device or Controller: A sensor, controller, or end device that is pre-programmed by the vendor. It may have physical inputs and physical outputs. The control logic, while not programmable, may be configurable through the use of configuration parameters. The application may require input network variables and may send output network variables onto the network.

10. Control Logic Diagram: A graphical representation of control logic for the multiple processes that make up a system. Logic symbols are used to represent:
   a. Input/Output (I/O) data.
   b. Control functions such as PID, two-position control, switches, etc.
   c. Math functions such as addition, subtraction, multiplication, division, etc.
   d. Boolean functions such as greater than, less than, equal to, etc.
   e. Limit functions such as maximum, minimum, ramps, etc.
11. Enterprise Level Data Manager (ELDM): A logic only device (controller without I/O) that is installed on the building LAN as the first node beneath the IP router. This device shall be programmable and be from the same Manufacturer that provides the enterprise level server and operator workstation software. The enterprise level data manager may be multiple identical devices installed on the building LAN in series in order to have sufficient capacity to support the building level controls. The enterprise level data manager may be combined in a single device with the IP router. The enterprise data manager serves 3 functions:
   a. Time Schedules: Time schedule algorithms shall reside in the enterprise level data manager. Occupancy/energize commands shall be broadcast to the building level controllers in the number required by the sequence of control.
   b. Trend Data Storage: The enterprise level data manager shall collect data from the building level controls at specified intervals and store the data for periodic uploading to the server. Polling communication techniques are acceptable for data collection by the data manager.
   c. Alarm Generation: The enterprise level data manager shall receive binary alarm variables from the building level controllers and transmit this data to the alarm handling software module within the server and operator work stations. Receipt of alarm data from the building level controls shall be based on broadcasting from the building level controls and not based on polling by the enterprise level data manager.

12. JACE: Java Control Engine. A term used within the Niagara Framework to describe an enterprise level data manager.

13. Managed Communication: The transmission of data from a controller to a data manager, which in turn rebroadcasts the data to a second controller. The data manager may be referred to a network controller.

14. Peer to Peer Communication: Data is broadcast from its origin and is received by the final device requiring the data without being received and retransmitted by a third device.

15. Standalone Controller: A standalone controller has provisions for all of the physical inputs and physical outputs associated with a single mechanical component such as a terminal unit, air handling unit, chiller or boiler. The controller shall also have embedded in it all of the control logic that associated the physical inputs to the physical outputs. A standalone controller will also have data management features such as time schedules, trend data storage and alarm message generation capabilities.


17. Web Server: A software package installed on a primary/secondary controller or ELDM that provides for operation access to the Enterprise Level system from a computer on the LAN, using only a browser.

1.6 DESIGN AND PERFORMANCE REQUIREMENTS

A. System layout and design responsibility are included as Work of this Section:
   1. Details of construction, quantities, components and accessories indicated on the Drawings and in the Specifications are minimum requirements.
   2. Increases in system component requirements beyond these minimums that are determined by the system designer to be necessary to provide the functional intent and for a complete system shall not be a basis for an increase in cost to Owner.

B. Comply with the following performance requirements:
   1. Graphic Display: Display graphic with minimum 20 dynamic points or as required to display required data.
   2. Graphic Refresh: Update graphic with display with current data within 8 seconds.
   3. Object Command: Reaction time of less than 2 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 6 seconds.
   5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within 5 seconds of each other.
   6. Program Execution Frequency: Run capability of applications as often as 5 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: ±1 degree F (0.5 degree C).
   b. Water Flow: ±5% of full scale.
   c. Water Pressure: ±2% of full scale.
   d. Space Temperature: ±1 degree F (0.5 degree C).
   e. Ducted Air Temperature: ±1 degree F (0.5 degree C).
   f. Outside Air Temperature: ±2 degree F (1.0 degree C).
   g. Dew Point Temperature: ± 3 degree F.
   h. Temperature Differential: Plus or minus 0.25 degree F (0.15 degree C).
   i. Relative Humidity: ± 5%.
   j. Airflow (Pressurized Spaces): ±3% of full scale.
   k. Airflow (Measuring Stations): ±5% of full scale.
   l. Airflow (Terminal): ±10% of full scale.
   m. Air Pressure (Ducts): ±0.1-inch wg (25 Pa).
   n. Carbon Dioxide: ± 50 ppm.
   o. Electrical: ±5% of reading.

1.7 SUBMITTALS

A. Submit the following in accordance with Division 01 Section “Submittal Procedures.”

B. Bid Submittals:
   1. A description of the proposed system, including a schematic diagram showing system architecture and all major components. Indicate all controllers and devices at the LAN layer.
   2. Original Manufacturer’s literature for each type of controller, processor and input/output device that is shown on the schematic diagram.
   3. Written verification that specified sequences of operation can be followed and performance requirements met, or a written list of variances required.
   4. Written verification that all accessibility and interoperability requirements will be met, or a written list of variances required.
   5. A specific description of proposed hardware and software expansion capabilities beyond the requirements described herein.
   6. A sample logic schematic for at least 1 system similar to one used in this project.
   7. Installer’s Qualifications: Include certifications, experience of similar projects and other evidence of qualifications for this Work.

C. Submittals Prior to Construction:
   1. A description of the complete system, including a schematic diagram showing system architecture and all major components, cabinets, panels, sensors, controllers, hubs and operated devices, and required cabling between each.
      a. Include any environmental and space requirements for equipment.
      b. Anticipated deviations from performance and response time specified.
      c. A layout drawing indicating locations of controllers and major devices.
   2. Front-End Hardware and Software:
      a. Dimensions and installation requirements.
      b. Equipment and material specification data.
      c. Function/identification labeling.
      d. Clearly mark (in ink) all preprinted information.
   3. Sensors, Controllers, Actuators and Related Devices:
      a. Complete system wiring diagrams and/or piping schematic including motor starters.
      b. Specification sheets on all individual control system components, including rated accuracy of sensors.
      c. Schedule of valves and dampers including size and performance characteristics.
   4. Complete Descriptions of Operation:
      a. Written sequences for software and hard-wired controls.
      b. A sequence of control for each system being controlled. Include the following as a minimum.
         1) Process control sequence for each end device.
         2) Supervisory logic sequence of control for each system.
3) The impact of each global application program on the sequence of control (Example: Demand Control).
4) A list of all physical inputs and outputs associated with each sequence.
5) Within the sequence of control, all application parameters that are to be user adjustable from an operator work station (OWS) shall be annotated with (adj) after the name of the parameter. This shall include setpoints, reset schedule parameters, calibration offsets, timer settings, control loop parameters such as gain, integral time constant, sample rates, differentials, etc.
6) Within the sequence of control, all calculated values that are to be viewable at the OWS shall be annotated with (rpt) after the name.
7) All points that shall be subject to manual control from an operator workstation.
8) A list of all alarm points, a description of the alarm and a description of the alarm criteria.
9) A list of all variables for which historical trending will be applied, the sample rates and any criteria used to start and stop the historical trending.

5. Graphic Pages: Submit a sample graphic page for each type of page described in the specification section of graphic pages.
6. Wiring diagrams.
7. System Schematics: Include systems furnished by others that are integrated into the DDC system.
8. Logic Schematics:
   a. Provide for each system and subsystem a complete logic schematic indicating all inputs, outputs, decisions, etc.
   b. Provide schematic format which includes all of the elements defined above.
   c. Provide a legend for all symbols used.
9. Information of a general, non-project specific nature is not acceptable.
10. Start-up Testing Plan: Submit a start-up testing plan for each unique system.
    a. The purpose of a start-up test is to demonstrate the “completeness” of the physical tasks associated with installation and the physical performance of the components.

D. Submittals After Construction:
1. Start-up Testing Report:
   a. Start-up testing reports shall be submitted on a per system basis.
   b. Start-up testing reports shall be the documented results of the executed start-up testing plans.
2. Operating and Maintenance Instructions: For all system components requiring maintenance include all maintenance information as required in Division 1 Section “Submittal Procedures” in addition to the following:
   a. Descriptive System Information: Include system logic schematics, input/output functions and Sequences of Operation.
   b. Operating Instructions: Include schedules and procedures for starting, stopping, cleaning, protection, testing, adjustments, calibration and replacement of components.
3. As-Built Documentation:
   a. Upon completion of the installation, and prior to acceptance by the Owner’s representative, Hi&C Contractor shall furnish as-built documentation and should include, but is not limited to the following:
      1) Points list in accordance with processor.
      2) Process flow diagram.
      3) Location plans.
      4) Operating sequences.
   b. All changes to the above submitted drawings, equipment descriptions and operation manuals shall be clearly identified on the as-built documentation.
4. Software:
   a. Submit a copy of all software installed on the servers and workstations.
   b. Submit all licensing information for all software installed on the servers and workstations.
   c. Submit a copy of all software used to execute the project even if the software was not installed on the servers and workstations.
   d. Submit all licensing information for all of the software used to execute the project.
   e. All software revisions shall be as installed at the time of the system acceptance.
5. Firmware Files:
   a. Submit a copy of all firmware files that were downloaded to or pre-installed on any devices installed as part of this project.
      1) This does not apply to firmware that is permanently burned on a chip at the factory and can only be replaced by replacing the chip.
   b. Submit a copy of all application files that were created during the execution of the project.
   c. Submit a copy of all graphic page files created during the execution of the project.
   d. Submit a copy of all secondary graphic files such as bitmaps, jpegs, etc. that were used in the creation of the graphic pages.

1.8 QUALITY ASSURANCE

A. Fabrication, Programming and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.
   3. 3 years minimum experience in the design and installation of HI&C work similar to that specified herein.
   4. Have a field office within 150 miles of Owner's installation staffed with factory-trained personnel capable of routine maintenance and emergency service.

B. Pre-Approved Installers: The following organizations are acceptable and are considered to meet the qualification requirements of this project:

C. Regulatory Agencies Requirements:
   1. All temperature control wiring shall comply with NEC.
   2. All pneumatic piping installation shall comply with all state and local codes and ordinances.
   3. All smoke detectors shall bear the UL label and be FM approved.
   4. All components used for smoke control shall comply with UL864.
   5. All DDC I/O Devices (Specified and Future):
      b. Furnished with EIA (Electronic Industries Association) interface hardware.
   6. All instrumentation hardware shall be ISA (Instrument Society of America) compatible.
   7. All primary components of DDC hardware shall be UL listed (UL916).
   8. Installation shall comply with FCC (Federal Communications Commission) rules for Class A and Class B computing devices pursuant to Subpart J of Part 15.
   9. ASHRAE Standard 135, BACnet/IP.
   10. Network wiring shall comply with EIA/TIA Standards.

1.9 WARRANTY

A. In addition to the warranty provisions defined in the General Conditions, provide an extended warranty of a minimum 1 additional year (2 years total).

1.10 SERVICE AGREEMENT

A. Provide 12-month service and maintenance contract paid in full:
   1. Within 30 days after Substantial Completion.
   2. Signed by Manufacturer's authorized representative.

B. Programming and Setpoint Adjustments:
   1. In addition to service and maintenance, include 20 hours for adjustments in setpoints, reset schedules, and sequence revisions as directed by the Owner to "fine tune" control systems to building and occupant characteristics through 1 year of seasonal changes under full operation.
   2. Documentation:
      a. Submit documentation of actual time spent for programming and setpoint adjustments within 30 days after completion of the work for approval by Owner or Engineer.
      b. Time spent for service and maintenance as included above is not part of this allotment and is to be documented separately.
1.11 OWNERSHIP OF PROPRIETARY MATERIAL

A. The Owner shall retain all rights to software for this project.

B. The Owner shall sign a copy of the Manufacturer’s standard software and firmware licensing agreement as a condition of this Contract. Such license shall grant use of all programs and application software to the Owner as defined by the Manufacturer’s license agreement, but shall protect the Manufacturer’s rights to disclosure of trade secrets contained within such software.

C. The licensing agreement shall not preclude the use of the software by individuals under contract to the Owner for commissioning, servicing or altering the system in the future. Use of the software by individuals under contract to the Owner shall be restricted to use only for the purpose of commissioning, servicing or altering the installed system.

D. All project developed software, files and documentation shall become the property of the Owner. These include but are not limited to:
   1. Server and workstation software.
   2. Application programming tools.
   3. Configuration tools.
   4. Addressing tools.
   5. Application files.
   6. Configuration files.
   7. Graphic files.
   9. Graphic symbol libraries.
  10. All documentation.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. General:
   1. Provide a micro-processor based logic system using low voltage electricity as a communication medium with an open architecture and distributed intelligence.
   2. All controlled components, sensors and controllers shall be addressable except:
      a. Terminal heating units such as unit heaters, cabinet heaters, convectors, finned tube.
      b. Ventilation fan and damper systems serving a single room and moving 1,000 cfm or less.
   3. Provide completely computerized system using low voltage electricity as the operating medium.
   4. System Functions:
      a. Digital operation in accordance with preprogrammed strategies to control temperatures, energy use and selected electrical/mechanical equipment.
      b. Capable of mathematical computation and logical/relational functions as required to achieve specified control strategies.
      c. Capable of off-loading programs and accumulated data to magnetic media and a web browser.
      d. Provide battery-powered RAM devices for program storage.
      e. Continuous self-checking capability.
      f. English language message display for all alarm and fault conditions.

B. Interoperability:
   1. The system specified herein is a peer-to-peer addressable, standalone distributed control system integrating ANSI/ASHRAE Standard 135 (BACnet) technology and communication protocols in a common interoperable system. The system shall allow future expansion and modifications to the system with complete addressability without the use of proprietary components or software.
   2. All software and intelligent devices shall comply with BACnet standards to provide complete interoperability between all system components.
      a. Each BACnet device shall be furnished with a protocol information conformance statement (PICS) certifying compliance to a minimum of Level 3.
   3. System shall provide complete password-protected accessibility to all devices, controllers and data using Java enabled web browsers without the requirement for proprietary software.
C. System Architecture:
   1. The system architecture shall consist of 2 layers, the LAN layer and the field bus layer.
   2. The TCP/IP layer connects all of the buildings on a single-wide area network (WAN) isolated behind the Owner’s firewall. Fixed IP addresses for connections to the Owner’s WAN shall be used for each device that connects to the WAN.
   3. Each field bus shall consist of multiple segments with no more than 125 total connected devices. Each segment shall be isolated from the other segments by a repeater. Each segment shall have no more than 30 connected devices.

D. Networking:
   1. All devices that connect to the LAN/WAN shall be capable of operating at 10 megabits per second or 100 megabits per second.
   2. LAN/WAN To Field Bus Routing Devices:
      a. A BACnet Building Controller shall be used to provide this functionality.
      b. These devices shall be configurable locally with RS232 or IP crossover cable and configurable via the LAN/WAN.
      c. The routing configuration shall be such that only data packets from the field bus devices that need to travel over the LAN/WAN level of the architecture are to be forwarded.

2.2 MANUFACTURERS

A. Subject to compliance with interoperability requirements and these Specifications, hardware, software, and components shall be supplied by and bear the name of 1 or more of Manufacturers listed below. Alternate Manufacturers are also listed in this Specification for individual components.

B. Acceptable Manufacturers:
   1. Siemens Building Technologies, Inc.

C. Stocking Requirements: All valves, operators, standard electrical components, and other replaceable parts shall be normally stocked within a 100 mile radius of the job Site.

D. Electrical Components: Provide electrical components as specified in Division 26 and as manufactured by the acceptable Manufacturers listed therein.

2.3 HARDWARE SYSTEM REQUIREMENTS

A. System Architecture:
   1. Provide hardware comprised of a local building level primary controller and local control modules.
   2. User programmable.
   3. Provide Communication Networks:
      a. Local links for distributed programming, data interchange and control at all system levels.
      b. Web server for remote access through Internet lines to all system functions and levels with firewall.
   4. Standalone capability for local control modules.
   5. Analog Input:
      a. Analog sensing elements for remote indication to be independent of local sensors used for local control loops.
      b. The A/D conversion resolution shall not exceed 0.01 volts per count.
   6. Binary Input:
      a. Air flow status for each fan shall be indicated by means of a differential pressure sensing device which opens an electrical contact as the differential pressure falls below an adjustable pressure range setting.
   7. Output Control:
      a. Provide the necessary relays and wiring required to start and stop points, specified on the point list, through their respective existing control circuit.
      b. Wiring required to complement the following control functions:
         1) Auto: In the auto control, the existing control sequence is not changed.
         2) Close: In the close control, the controlled device is maintained in the fully closed position.
B. System Features:
1. Modular construction and interoperable protocol to ensure future expansion capability with interconnection of system modules.
2. Software configurable input and output points.
3. Expandable Point Capacity:
   a. At any point along the network without hardwiring points back to a central control panel.
   b. Provide a minimum of 10% spare outputs user configurable for digital or analog.
   c. System shall be modularly expandable to at least twice the installed capacity using additional hardware.

C. System Communication:
1. High Speed LAN and/or WAN Based, Arcnet or Ethernet Compatible: Capacity for a minimum of 2 operator stations, allowing concurrent multiuser, multitasking access to DDC network and control units.
2. Provide transparent peer-to-peer communication between all control panels.
3. Support an Internet communication link utilizing standard Internet protocol.

D. Operator Interface:
1. Provide fully programmable remote web based access capabilities allowing alarm management and setpoint and schedule adjustments.
   a. User interface shall be graphical in accordance with requirements below.
2. Building Level Processor:
   a. Run and print reports on specific equipment including AHUs, pumps, terminal units, boilers, etc.
   b. Monitor and edit equipment scheduling parameters.
   c. Receive and monitor alarms.
   d. Exchange data (read and edit) between all the various control panels.
   e. Receive and send data such that, from an off Site work station, all the functions listed under Items a, b, c, and d above, can be performed without the addition of new hardware or software.
3. At Local Control Modules:
   a. Peer-to-Peer Communications:
      1) Through an operator interface device, such as a laptop, hand held computer or touch pad screen, transparent interfacing to all other control panels shall be achieved such that it shall be as if being connected to the other control panel itself, without having to set up any separate communication services.
      2) Data, status information, reports, system software, custom programs, sensor data, etc., for all controllers shall be available for viewing and editing purposes.
   b. Any Manufacturer's HVAC equipment using BACNet control and communication protocol provided with it, could be installed and connected at any time to the control panel system and transparently provide all sequence of operation controlling points and alarms, as if it came with the central control system's brand name controls on it, without having to add additional equipment.
   c. Additional input and output points can be conveniently added via adding expansion modules.
4. Application Software (latest versions reside on microcomputer):
   a. Input/output capability from operator station.
   b. System access level via software password.
   c. Database creation and support.
   d. Dynamic color graphic displays.
   e. Alarm processing.
   f. Event processing.
   g. Data collection.
   h. Full building graphics development.
   i. Maintenance management.
   j. Control software.
   l. Trending applications.
   m. Control Manufacturer's internet website server link.
5. Portable Access Device: Furnish a hand-held control system interface device that will be used during commissioning and will be turned over to Owner upon completion of Project.
E. Primary Controller:
   1. Features:
      a. Building-level control system, with on-board storage of programs and data, and with monitoring capabilities over all points in the building system.
      b. Capable of standalone operation, supervising local control modules without a host computer.
      c. Built-in, password-protected, multi-function keypad/display providing complete access to building-level monitoring and control.
      d. RS-232-C port for connecting an optional ASCII terminal and/or printer to supplement the built-in keypad/display terminal.
      e. Equipped with multiple processors, battery backup of RAM, and a battery backed-up real time clock.
   2. Functions:
      a. Supervise all necessary building and energy management functions programs, including global data distribution (phase/power loss, outdoor temperature, external alarm status), time-of-day scheduling, holiday scheduling, optimized start/stop, duty cycle control, demand control, run time logging, equipment and system alarm monitoring, and self-diagnostics.
      b. Network of local control modules (up to 256 input/output control points).

F. Secondary Controller:
   1. General:
      a. Provide input/output, electronic thermostat, and terminal box controller modules as indicated on the Drawings and as required to satisfy the functional intent description of this Section.
      b. Microprocessor-based with on-board program storage.
      c. Capable of functioning as the input/output interface between the system and the building/equipment environment, providing control and management functions as programmed.
      d. Capable of built-in bi-directional communication capability, over 2-wire cable or Ethernet, with the Primary Processor for programming and reporting functions and for supervision of all control and energy management operations.
      e. Standalone capability to maintain programmed local control functions and operations including direct digital control in the event communications with the Primary Processor are lost.
      f. Equipped with timed override switches to allow programmed off-hours operation.
      g. Provide with LED indicators or LCD display to show schedule status, output status and communication status.
   2. Input/Output Modules:
      a. Capable of the following local control capabilities:
         1) Supervisory and closed loop control.
         2) Setpoint and setback control.
         3) Positioning control.
         4) Proportional reset.
         5) Status monitoring.
         6) Equipment alarms.
         7) Sequencing (staging).
      b. Local parameters and settings shall be monitorable and modifiable through the Primary Processor keypad/display terminal.
      c. Perform energy and building management functions under supervisory control from the Primary Processor.
      d. After initial communication with the Primary Processor, standalone programmed capabilities shall be stored on-board, in memory with 2,000 hour battery backup.
      e. Equipped with 8 inputs and 8 outputs which shall be software configurable as either analog, digital or pulsed digital.
      f. Configuration:
         1) Inputs and outputs shall be surge and spike protected.
         2) Inputs shall employ noise immunity circuits.
         3) Outputs shall employ noise suppression circuits.
         4) Outputs shall be equipped with internal manual/auto selection capability for local maintenance and troubleshooting use.
         5) Provide suitable intermediate devices where the load being controlled exceeds the rating of the output, or uses a different operating medium.
3. **Electronic Thermostat Modules:**
   a. Provide modules capable of the following:
      1) All necessary programmed functions.
      2) Energy and building management.
      3) Local control and monitoring.
   b. **Features Required:**
      1) Automatic downloading by Primary Processor.
      2) Standalone operation after initial Primary Processor communication.
      3) RAM memory storage for failsafe, fixed setpoint program items.
      4) Permanent ROM memory storage for failsafe, fixed setpoint program items.
   c. Local control functions include, but are not necessarily limited to:
      1) Cooling sequencing.
      2) Heating sequencing.
      3) Scheduling.
      4) Fan on/off.
      5) Mixed air damper modulation.
      6) Temperature setback.
      7) Optimized start and stop.
      8) Timed override.
   d. Provide for input device signal interface:
      1) Temperature Sensor: 4-20 mA.
      2) Air flow switch.
      3) Override pushbutton.

4. **Terminal Box Controller Modules:**
   a. Provide modules capable of the following:
      1) All necessary programmed functions.
      2) Energy and building management.
      3) Local control and monitoring.
      4) Integrating Primary Processor functions into local programs.
   b. **Features Required:**
      1) Automatic downloading by Primary Processor.
      2) Standalone operation after initial Primary Processor communication.
      3) RAM memory storage for failsafe, fixed setpoint program items.
      4) Permanent ROM memory storage for failsafe, fixed setpoint program items.
   c. Local control functions include, but are not necessarily limited to:
      1) Damper positioning.
      2) Fan start/stop.
      3) Reheat coil valve modulation.
      4) Temperature setback.
      5) Timed override.
   d. Provide for input device signal interface:
      1) Temperature Sensor: 4-20 mA.
      2) Air flow switch.
      3) Override pushbutton.

G. **HVAC Unit Controls:**
   1. Provide unit controller modules as indicated on the Drawings and as required to satisfy the functional intent description of this Section.
      a. Microprocessor based with on-board program storage.
      b. Capable of functioning as the input/output interface between the system and the building/equipment environment, providing control and management functions as programmed.
      c. Capable of built-in bi-directional communication capability, over 2-wire cable, with the Primary Processor for programming and reporting functions and for supervision of all control and energy management operations.
      d. Standalone capability to maintain programmed local control functions and operations including direct digital control, in the event communications with the Primary Processor are lost.
      e. Equipped with timed override switches to allow programmed off hours operation.
      f. The DDC system control panel shall be capable of communicating with each individual rooftop and monitoring various points. There shall be 1 controller per rooftop that communicates back to the main control panel.
2. The HVAC controller shall be capable of monitoring and communicating the following information back to the system control panel:
   a. Analog Input Points:
      1) Outdoor air temperature.
      2) Supply air temperature.
      3) Space air temperature.
      4) Return air temperature.
      5) Active setpoint.
      6) Outdoor air relative humidity (%).
      7) Space air relative humidity (%).
      8) Outdoor air damper position.
      9) Return air damper position.
     10) Space carbon dioxide level.
   b. Binary Input Points:
      1) Smoke/fire alarm status.
      2) Heating status.
      3) Economizer enable/disable status.
      4) Hot condenser gas reheat, coil enable/disable status.
      5) Supply fan on/off status.
      6) Supply fan failure.
      7) Exhaust fan on/off status.
      8) Exhaust fan failure.
      9) Cooling contactor status.

3. The system control panel shall provide the following control functions for each RTU:
   a. Schedule all RTUs for heating night setback.
   b. Schedule all RTUs for a heating morning warm-up.
   c. Schedule night setup during cooling.
   d. Schedule all RTUs for optimum start and provide a program that automatically adjusts on a daily basis the morning start-up time based on the zone temperature versus the occupied setpoint and the historical recovery rate for each unit.

4. Remote Sensors:
   a. Air Temperature Sensor Quantity:
      1) See location detail on the Drawings.
   b. Each space shall be provided with a temperature sensor.
   c. Sensors shall provide input to the RTU controllers.
   d. Sensors shall be located as indicated on the Drawings.

2.4 SOFTWARE SYSTEM FEATURES

A. The programmable energy and building management functions include, but are not necessarily limited to:
   1. User Setpoint Control:
      a. Time Of Day Scheduling:
         1) Capable of optimally starting based on individual unit recovery ramps.
         2) Time of day scheduling shall be continuous, such that if power is lost, on power up, the panel will look back for each device to see whether it should be on/off or in occupied/unoccupied temperature setpoints.
      b. Holiday and weekend schedules.
      c. Space temperature setpoint control.
      d. Space humidity setpoint control.
      e. Space ventilation setpoint control.
      f. Timed Override:
         1) Each scheduled device shall be able to be overridden at the operator work station and space sensor to the occupied mode for up to 4 hours.
         2) The override shall also be cancelable from the operator work station at any time during the override.
   2. System Controller Features:
      a. Temperature reset.
      b. Economizer control (free cooling).
      c. Temperature control.
      d. Humidity control.
e. Terminal box grouping.
f. Power fail restart sequencing.
g. PID loop control.
h. Data logging.
i. Duty cycling.
j. Optimized start/stop.
k. Demand limit control.
l. Control to greatest demand, with the ability to ignore specific demand inputs.
m. Event Log: The last 100 events shall be maintained for review at the OWS and remotely.
n. Daylight Savings Time:
   1) The system panel software shall automatically update time according to daylight savings at
      the legislated time and date, and reset time at the end of the daylight savings period.
   2) This function shall be able to be disabled.
3. Control programs include, but are not necessarily limited to:
   a. Setpoint (closed loop).
   b. Proportional reset.
   c. Sequencing by time and/or temperature.
   d. Limit and status monitoring.
   e. Local emergency overrides.
   f. Local timed schedule overrides.
   g. Outdoor temperature operating limits.
4. Capable of combining functions as required for specific user requirements.

B. User and Programmer Access:
1. User password protected.
2. Programmer password protected.

C. Custom Programming:
1. Provide a user-friendly, interactive, "on-line" programming language for the purpose of creating custom
   programs for specific, unique applications.
2. All custom programming must be performed in English language commands, and all inputs, outputs,
   variables and flags shall be addressable by user specific English names without requiring alphanumeric
   addresses or point numbers.
3. The system shall be programmable to allow or secure each of the above setpoint controls at each level.

D. Logs/Alarms:
1. Provide automatic logging of control alarms, critical alarms, kW demand history and kWh consumption.
2. Additional logging shall be programmable including, but not limited to:
   a. Equipment run time.
   b. Historic trends and logs.
   c. User defined meters.
   d. User access logs and point scans.
3. Provide alarm monitoring and reporting capabilities for all input points, including phase loss alarms,
   external alarms, load control alarms, critical alarms with auto-dial-up feature, alarm summary on printer,
   including time and date of alarm, and programmable power-failure restart sequence.
4. Audible Alarms:
   a. Provide audible alarm at building level processor for each alarm condition.
   b. Provide operator silencing. Reset daily.
5. At Control Panel Systems:
   a. Peer-To-Peer Communications:
      1) Through an operator interface device, such as a laptop, hand held computer or touch pad
         screen, transparent interfacing to all other control panels shall be achieved such that it shall
         be as if being connected to the other control panel itself, without having to set up any
         separate communication services.
      2) Data, status information, reports, system software, custom programs, sensor data, etc., for
         all controllers shall be available for viewing and editing purposes.
b. Any Manufacturer’s HVAC equipment using either LONtalk or BACNet control and communication protocol provided with it, could be installed and connected at any time to the control panel system and transparently provide all sequence of operation controlling points and alarms, as if it came with the central control system’s brand name controls on it, without having to add additional equipment.

c. Additional input and output points can be conveniently added via adding expansion modules.

d. Run and print trends of selected equipment performance characteristics in table and graph forms.

e. Run and print reports on specific equipment including AHUs, pumps, terminal units, chillers, boilers, towers, etc.

f. Monitor and edit equipment scheduling parameters.

g. Receive and monitor alarms.

h. Manage the network including monitoring of the loss of communication and clock setting functions.

i. Exchange data (read and edit) between all the various control panels.

j. Receive and send data such that from another control Manufacturer’s PC work station off Site from the primary head end, all the functions listed under Items a, b, c, d, e and f, above, can be performed without the addition of new hardware or software.

E. Program Descriptions:

1. Time-Of-Day Scheduling:
   a. Decrease energy consumption by turning off loads during unoccupied hours or unoccupied days.
   b. Programmable in 1 minute increments.
   c. Up to 64 discrete schedules in accordance with Primary Processor system.
   d. Up to 16 groups of loads (consisting of up to 16 loads each) for concurrent scheduling.
   e. Ability to assign loads to existing alternate schedules by linking.
   f. Timed overrides and temporary “today” and “tomorrow” schedules, for each schedule.

2. Setpoint/Setback Control:
   a. Decrease energy consumption by modifying space temperature setpoints during scheduled unoccupied hours, thereby reducing use of mechanical heating or cooling.
   b. Timed override off hours setpoint operation.

3. Optimized Start/Stop:
   a. Decrease energy consumption by learning building response to changing weather and automatically turning on HVAC as late as possible in the morning and off as early as possible in the evening, while meeting ambient temperature requirements during occupied hours.
   b. Optimized start and stop times updated daily.

4. Holiday Scheduling:
   a. Allow up to 16 holiday periods to be programmed.
   b. Each holiday period programmable for a maximum of 99 consecutive days.

5. Duty Cycle Control:
   a. Decrease kWh consumption by shedding and restoring electrical loads on a cyclic basis to reduce total on time.
   b. Programmable cycle interval and on time.
   c. Minimum off and on times to prevent damage to equipment.
   d. Demand peak limit on initial start by staggered on times.

6. Demand Limit Control:
   a. Monitor and control demand kW for up to 128 loads.
   b. Able to monitor up to 4 electric meter or pulse type watt transducers.
   c. Maintain demand peak limit by turning loads on and off, or by adjusting setpoints, to keep peak below a programmed setpoint.
   d. Based on 30-second integration of demand, the rate of increase or decrease, and the historic effects of load shedding and restoring.
   e. Programmable minimum on times, minimum off times, maximum off times, temperatures and other limits and overrides.
   f. Programmable shedding and restoring in rotational/sequential order with 4 levels of priority.

7. Temperature Reset:
   a. Capable of user-defined linear proportional reset functions.
   b. Programmable reset parameters, variables and limits.
   c. Variables programmable as the highest, lowest or average of multiple inputs.
8. Economizer Control (Free Cooling):
   a. Reduce energy consumption by utilizing outside air for cooling:
      1) Enthalpy based.
      2) In lieu of mechanical cooling equipment.
   b. Programmable to operate fan systems during unoccupied hours of the cooling season in the maximum outside air mode.

9. Direct Digital Temperature Control:
   a. Maintain automatic temperature control directly by the local control module microprocessor.
   b. Local module capable of performing all necessary local control functions.

10. Terminal Box Grouping: The DDC shall be able to group VAV boxes via keyboard commands. These terminal unit groups shall make it possible to:
   a. Send a common command to all boxes in a group to operate in the same mode.
   b. Offset heating or cooling setpoints of 1 or more terminal unit groups by an adjustable amount.
   c. Receive and display information on a group basis, including, but not necessarily limited to:
      1) Minimum group temperature.
      2) Maximum group temperature.
      3) Average group temperature.
      4) Current airflow through boxes in group.

2.5 ELECTRICAL DEVICES AND WIRING

A. Comply with all local codes and applicable Sections in Division 26 of these Specifications.

B. Low Voltage Wiring (24V or Less):
   1. Installed in a ceiling plenum used for return air shall be plenum rated wire securely fastened in accordance with the requirements of Division 26.
   2. Exposed wiring shall be installed in accordance with the requirements of Division 26.

C. Approved Manufacturers:
   1. Siemens.
   3. GE.
   4. Square D.

D. Limit Switches: Limit switches shall be oil tight type with appropriate operator to provide required function. Limit switches used on dampers should be set at approximately 75% of full stroke.

E. Control Relays and Contactors:
   1. Relays shall be a minimum DPDT, of proper coil voltage, with indicator light, and of sufficient rating for specified purpose. Relay base shall be of the screwed terminal type.
   2. Contactors shall be definite purpose type, have adequate number of poles, of proper coil voltage, and of sufficient rating for specified purpose.

F. Selector Switches:
   1. Switches shall be multiple position type, oil-tight, watertight, dust-tight, have the adequate number of contact blocks, capable of additional contact blocks, and of sufficient rating for specified purpose.
   2. Nomenclature plate shall be provided with appropriate wording, units, etc.

G. Push Buttons and Pilot Lights
   1. Push button switches and pilot lights shall be, oil-tight, watertight, dust-tight, have the adequate number of contact blocks, capable of additional contact blocks, and of sufficient rating for specified purpose.
   2. Nomenclature plate shall be provided with appropriate wording, units, etc.
   3. Pilot lights shall be LED, push-to-test type with replaceable lamps and lens. Lens shall be of the appropriate color for application served.

H. Environment:
   1. All devices shall be of the correct NEMA rating for the environment in which it is installed.
   2. Refer to Electrical Drawings for area classifications.
2.6 ELECTRIC INSTRUMENTS

A. Thermistor Temperature Sensors and Transmitters:
   1. Accuracy: \( \pm 0.5 \) degrees F (0.3 degrees C) at calibration point.
   2. Wire: Twisted, shielded pair cable.
   3. 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 sf (0.84 sq. m).
   4. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches (64 mm).
   5. Room Sensor Cover Construction: Manufacturer's standard locking covers.
      a. Setpoint Adjustment: Exposed.
      c. Thermometer: Concealed.
   6. Outside Air Sensors: Watertight inlet fitting, shielded from direct sunlight. Provide vandal resistant enclosures where accessible to the public.

B. RTDs and Transmitters:
   1. Accuracy: \( \pm0.2 \) percent at calibration point.
   2. Wire: Twisted, shielded-pair cable.
   3. 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).
   4. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches (64 mm).
   5. Room Sensor Cover Construction: Manufacturer's standard locking covers.
      a. Setpoint Adjustment: Exposed.
      c. Thermometer: Concealed.
   6. Outside Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

C. Low Temperature Detection:
   1. Provide Electric Thermostat:
      a. With 20-foot sensing element installed in a serpentine manner across the coil face area.
      b. 2-position manual reset type with adjustable differential and of range to match the application.
   2. Provide multiple thermostats wired in series as required to provide complete coil area coverage.
   3. Shut down the unit supply fan upon detection of a low temperature along any 1-foot length of its sensing element.

D. Static Pressure Transducer:
   1. Factory installed and wired in the control box.
   2. The transducer shall have a range of 0 to 5-inch W.G. and shall have an accuracy of \( \pm 2\% \) of the range, including nonlinearity and hysteresis.
   3. The static pressure probe shall be field installed 2/3 down the duct or as indicated on the Drawings.

E. Differential Air Pressure Switch:
   1. The differential air pressure switch shall be factory installed across the supply fan inlet and discharge and field wired to the fan relay.
   2. The switch shall be SPDT and shall include a manual reset button.
   3. The switch shall be factory set at 3.0-inch W.G. and shall have the ability of being field adjusted over a range of 1.4-inch to 6.0-inch W.G.

F. Relative Humidity Transmitter:
   1. Polymer film capacitance change type.
   2. Temperature compensated.
   3. Accuracy: \( \pm 2\% \).
   4. Range: 0 - 100% relative humidity.
   5. Ambient Temperature: 0 - 120 degrees F.
   6. Output Signal: 4 to 20 mA or 0 to 10 VDC, as required.
   7. Manufacturers:
      a. General Eastern Instruments Corporation.
      b. Vaisala, Inc.
G. Dew Point Transmitter:
1. Saturated salt lithium chloride type.
2. Accuracy: ±1 degree F.
3. Range: 12 to 99% relative humidity.
4. Ambient Temperature: -40 to 140 degrees F.
5. Input Power: 24 VDC or 115 VAC, as required.
6. Manufacturers:
   a. General Eastern Instruments Corporation.
   b. Vaisala, Inc.

H. Carbon Dioxide Sensor:
1. Manufacturer and Model: Johnson Controls, CDS-2000-2; or approved equal.
2. Description: Carbon dioxide sensor using non-dispersive infrared (NDIR) sensing technology to measure carbon dioxide and provide a 1-10 VDC output signal corresponding to 2-2000 parts per million (ppm) concentration of carbon dioxide.
3. Components:
   a. Carbon dioxide sensor capable of measuring carbon dioxide concentration in air from 0-2000 ppm.
   b. 24V AC transformer to power carbon dioxide sensor.
   c. Supply air flow filter which inhibits sensing chamber contamination.
   d. 2 front-mount wiring terminals blocks.
4. Performance Requirements:
   a. Accuracy: ±100 ppm carbon dioxide.
   b. Repeatability: ±20 ppm carbon dioxide.
   c. Drift: ±100 ppm carbon dioxide per year.
   d. Response Time: Less than, or equal to 30 seconds maximum.
   e. Airflow Rate: 500 milliliters per minute at 1.4 psi ±10% through 1/4-inch O.D. tubing.

2.7 GAGES
A. Comply with the requirements of Division 23 Section “Meters and Gages for HVAC Piping.”
B. Air Pressure Gages:
   1. Provide 1-1/2-inch diameter gages at all input sensor lines, switch lines, branch side of each controller and at each controlled device.
   2. Stem or surface mounted as required.
   3. Compatible with tubing size.
C. Temperature, Humidity and Pressure Indicators:
   1. Dial type having a minimum diameter of 3-1/2 inches, adjustable calibration, and accuracy of ±1/4% of dial range.
   2. Thermometer ranges to match the range of the transmitter with which used.
   3. Furnish for all transmitters as described in the Functional Intent article of this Section.
D. Alternate Manufacturers: As listed in Division 23 Section “Meters and Gages for HVAC Piping.”

2.8 AIRFLOW MEASURING STATIONS
A. Pitot Tube Type:
   1. Manufacturers:
      a. Air Monitor Corporation.
      b. Cambridge Filter Corporation.
   2. Multi-pitot type with output signal based on equal area static pressure sensors.
   3. Accuracy of ±2% of air flow quantity.
   4. Designed for direct insertion in the duct system and of a configuration compatible with ductwork at installation point.
   5. Frame constructed of 16 gage minimum galvanized steel.
   6. Device shall include necessary velocity treatment and flow straightening devices to achieve stated accuracy.
7. Provide permanent nameplate with the following information:
   a. Manufacturer's name and address.
   b. Unit size and serial number.
   c. Design air flow, velocity and direction.

B. Electronic Thermister Type:
   1. Manufacturer: Ebtron.
   2. Hermetically sealed bead in glass thermisters.
   3. 304 stainless steel mounting brackets.
   4. Plenum rated cabling.
   5. Accuracy: ±2% of reading at 0-5000 fpm.
   6. Repeatability: ±0.25% of reading.
   7. 16 character LED display.
   8. Fully temperature compensated.
   10. Interface with central building automation system.
   11. Device shall include necessary velocity treatment and flow straightening devices to achieve stated accuracy.

C. Provide as indicated on the Drawings or stated herein or in Division 23 Section “Sequences of Operation for HVAC.”

2.9 AUTOMATIC CONTROL VALVES AND ACTUATORS

A. Furnish valves in accordance with the requirements of Division 23 Section “General Duty Valves for HVAC.”

B. Control Valve Actuators:
   1. Size to operate with sufficient reserve power to provide smooth modulating action or 2-position action.
   2. Close-off (differential) pressure rating.
   3. Hydronic Systems: Combination of actuator and trim shall provide minimum close-off pressure rating of 150% of total system (pump) head for 2-way valves and 100% of pressure differential across valve or 100% of total system (pump) head.
   4. Steam Systems: Combination of actuator and trim shall provide minimum close-off pressure rating of 150% of operating (inlet) pressure.
   5. Provide with neck extension on insulated service
   6. Electric Actuators and Motors:
      a. Manufacturers: Subject to compliance with the requirements, provide products by one of the following:
         1) Johnson.
         2) Honeywell.
         3) Belimo Aircontrols (USA), Inc.
         4) Siemens.
      b. Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
      c. Serviceable and rebuildable.
      d. Coupling: V-bolt and V-shaped, toothed cradle.
      e. Overload Protection: Electronic overload or digital rotation-sensing circuitry.

2.10 AUTOMATIC CONTROL DAMPERS AND OPERATORS

A. Furnish dampers in accordance with the requirements of Division 23 Section “Dampers.”

B. Damper Operators:
   1. General:
      a. Sized for ample power to overcome friction of damper linkage and air pressure acting on the blades.
      b. Capable of operating at varying rates of speed to correspond to the dictates of the controllers and variable load requirements.
c. The operator linkage arrangement shall be such as to permit normally open or normally closed positions of the dampers as required.

2. Electronic Damper Actuators:
   a. Direct coupled type designed for minimum 60,000 full stroke cycles at rated torque.
   b. Coupling: V-belt and V-shaped, toothed cradle.
   c. Overload Protection: Electronic overload or digital rotation sensing circuitry.
   d. Fail Safe Operation: Mechanical, spring return mechanism. Provide external, manual gear release on non-spring return actuators.
   e. Temperature Rating: -22 to +122 degrees F.

2.11 INSTRUMENT TEST HOLES

A. Provide surface mounted, flanged test holes with removable caps and of sufficient length to extend beyond external duct insulation.

B. Install at all control points in ductwork, including, but not necessarily limited to:
   1. Discharge air controllers.
   2. Return air controllers.
   3. Mixed air controllers.
   4. Pressure sensors.
   5. Limit thermostats.
   6. Temperature sensors.

C. As manufactured by Ventfabrics, Inc.; Ventlock, Model 699; or equal.

2.12 CONTROL PANELS

A. Located within mechanical equipment rooms.

B. UL listed for line voltage system with removable face panel.

C. Furnish in Manufacturer's standard color.

D. Constructed and installed in accordance with Article 409 of the NEC (NFPA 70).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Air Piping:
   1. Install in neat and workmanlike manner, parallel to walls.
   2. Concealed runs of nonmetallic tubing must be in conduit.
   3. Exposed runs must be hard copper or suitably protected nonmetallic tubing.
   4. Seal all tubing and conduit penetrations at fire rated walls:
      a. With approved fire stop system.
      b. As specified in Division 7 Section “Penetration Firestopping.”
   5. Run all tubing concealed in finished areas.

B. Electrical Wiring:
   1. Motor Starters:
      a. Provide independent control circuit to each motor starter contactor coil.
      b. Provide a normally open interlock contact in each motor starter to indicate contactor status at DDC.
      c. Provide one electrically separate, normally open contact to start or stop each motor controlled by the system.
2. Limit Interlocks:
   a. Wiring of limit interlocks and dampers shall include on-off-auto switch on speed controllers.
   b. Wiring of all limit interlocks shall be such that the equipment will be de-energized in all operating
      positions of the starter.
3. Provide separate branch circuits for all 120 VAC power serving DDC equipment and related
   components.

C. Duct Pressure Sensors:
   1. Locate and set duct static pressure sensors as indicated on the Drawings or as instructed by the
      Engineer.
   2. Allow for one relocation and one reset of each static pressure sensor as instructed by the Engineer at
      no additional cost to the Owner.

3.2 FIELD QUALITY CONTROL

A. Demonstration and Acceptance Test:
   1. Operate each and every phase of the control system separately, or in conjunction one with the other:
      a. For a sufficient period of time to demonstrate the ability of the system to meet performance
         requirements in accordance with the true intent and purpose of these Specifications.
      b. Provide for notification and approval of Engineer as required by Division 01 Section “Starting and
         Adjusting.”
   2. The HI&C Subcontractor is responsible for verifying and demonstrating that each Sequence of Operation
      is being performed and design conditions stably maintained under operating conditions.
   3. Acceptance of performance will be provided by the CxA.
   4. Provide 8 hours of field service time for demonstration and acceptance test. Additional costs required
      due to retesting due to failure of system to perform satisfactorily shall be the responsibility of HI&C
      Subcontractor.
   5. Trend Logging:
      a. Submit a 2 week log in graph form of inputs and outputs on a 1/2-hour basis. As indicated on the
         Table (included at end of this Section), a minimum of the following systems will be included:
      b. Data is to be provided in an electronic spreadsheet or ASCII format on electronic media.
      c. Submit trend data at start-up and also during cold and warm weather for the systems indicated
         on Table at the end of this Section:

B. Operator Instruction:
   1. During system commissioning, and at such time acceptable performance of the system hardware and
      software has been established, provide onsite operator instruction to Owner's operating personnel.
   2. Operator instruction during normal working hours shall be performed by competent Manufacturer's
      representative familiar with the software, hardware and accessories.
   3. At a time mutually agreed upon during system commissioning as stated above, provide 8 hours of
      instruction to Owner's designated personnel on the operation of all equipment within the system and
      describe its intended use with respect to the programmed functions specified.
   4. Includes, but is not necessarily limited to:
      a. The overall operational program, equipment functions (both individually and a part of the total
         integrated system).
      b. Commands.
      c. Advisories.
      d. The appropriate operator's intervention required in responding to the system's operation.
      e. A description of the chronological information flow from field sensors, contacts and devices to the
         centrally located control console.
      f. The overview of the system's communication network to acquaint the operator of the interplay
         between initiating devices, remote processing units, loop communications and their importance
         within the operating system.
   5. Provide additional information time, as deemed necessary by Owner's authorized representative, on a
      negotiated basis with Owner.

C. Troubleshooting: Comply with the requirements of Division 23 Section “General HVAC Provisions,” Article
   1.7, for troubleshooting.
3.3 ADJUSTMENTS AND CALIBRATION

A. Upon completion of this Project, adjust and validate all thermostats, controllers, valves, damper operators, relays, and other components provided as part of the temperature control system.

B. Calibration:
   1. After completion of installation, the pneumatic piping shall be tested for leaks.
   2. Provide calibration documentation to Engineer, which shall include:
      a. Airflow transmitter calibration curves to relate the transmitter output signal to the actual airflow as well as to the pressure drop across the primary flow measuring element.
      b. For pressure, differential pressure, flow, and other transmitter's provide calibration curves using the zero, span and 3 other points between 10% and 90% of span. These curves shall relate the output signal of the transmitter to the primary measured value.
      c. Indicating instruments shall read true conditions and be checked with test instruments.
      d. Calibration of temperature and humidity sensors.

C. Adjustments, Tuning and Start-up:
   1. After the completion of calibration, adjust and tune the controls.
   2. Provide documentation, which is to include:
      a. Input/output relationship of all controllers, positioners, and final drive units.
      b. Gains and time constants established in all controllers.
      c. Loop setpoints.
      d. Limits on control actions.
      e. Alarm limits.
      f. Control dead bands.
   3. Provide seasonal adjustments as required under Article 1.10 - Service Agreement.
PROVIDE THE FOLLOWING TRENDS IN GRAPH FORM:

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<th>Trend with Warm Weather</th>
<th>Supply Air Temp</th>
<th>Outdoor Air Temp</th>
<th>Controlled Setpoint</th>
<th>Distribution Supply Wtr Temp</th>
<th>Distribution Return Wtr Temp</th>
<th>Source Equip On-Off Cycles</th>
<th>Distribution Pumps On-Off Cycles</th>
<th>Control-led RH Level</th>
<th>Mixed Air Temp</th>
<th>Space Temp</th>
<th>Sensed Static Pressure Level</th>
<th>Damper or Valve Position</th>
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END OF SECTION 23 09 00
SECTION 23 20 19 – PIPING SPECIALTIES 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 the furnishing and installation of piping specialties.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:

1. ASTM Specifications:
   c. A193 - Alloy Steel and Stainless Steel Bolting Materials for High-Temperature Service.
   d. A278 - Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F.

2. ANSI Standards:
   b. B16.5 - Pipe Flanges and Flanged Fittings.
   c. B16.24 - Bronze Pipe Flanges and Flanged Fittings, Class 150 and 300.

3. ASME American Society of Mechanical Engineers:
   a. Boiler and Pressure Vessel Code - Section II.
   c. B31.5 - Building Services Piping.

1.4 SUBMITTALS

A. Manufacturer's Literature: For all items listed in PART 2 – PRODUCTS. Include dimensions, details of construction and installation, name of Manufacturer, and model.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

PART 2 - PRODUCTS

2.1 STRAINERS

A. Manufacturer: Armstrong, Mueller.

B. Type: “Y”.

C. Screen: 20 mesh brass, removable.

D. Area: 5 times pipe diameter.

E. Pressure Rating: Match piping.

F. Install in where indicated on drawings.
2.2 MANUAL AIR VENTS

A. Manufacturer: Bell & Gossett or Dole.

B. Size: 1/8-inch.

C. Type: Slotted head (Bell & Gossett 4V or Dole No. 9).

D. Location:
   1. All cabinet, unit heaters and air handler, and coils.
   2. At all high points in the piping.
   3. Wherever called for on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all piping specialties in conformance with:
   1. The Shop Drawings reviewed by Engineer.
   2. The Manufacturer’s recommendation.

B. Furnish and install all vibration isolators, flexible connections, expansion joints, expansion loops required to reduce noise transmissions and stress on equipment and piping.

C. Cold spring all piping installed with expansion joints and loops half of the total expansion. This requirement does not reduce the amount of expansion compensation required of the loop or joint.

END OF SECTION 23 20 19
SECTION 23 21 13 – HYDRONIC PIPING

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 furnishing and installation of a hydronic piping and circulation system for heating hot water.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. American Society of Mechanical Engineering (ASME):
      b. B31.9 - Code for Building Services Piping.
      d. Heating Boiler Code.

1.4 SUBMITTALS

A. Manufacturer's Literature: For all products listed in Part 2.
   1. General:
      a. Dimensions.
      b. Details of construction and installation.
      c. Name of Manufacturer.
      d. Model number.
   2. Flow Measurement Devices:
      a. Flow and pressure drop curves.
      b. List each application with flow and size clearly indicated.

B. Operation and Maintenance Manuals: For all flow measurement devices.
   1. Equipment function, normal operating characteristics and limiting conditions.
   2. Assembly, installation, adjustment and checking instructions.
   4. Guide to "troubleshooting".
   5. Parts lists and predicted life of parts subject to wear.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

1.6 MAINTENANCE

A. Valve and Vent Schedule:
   1. Provide the following schedules:
      a. Air Vents: Indicate air vent number and location of all manual air vents that are not attached to a univent, heating unit, ventilating unit or other equipment.
      b. Valves: Indicate valve number, location and function of all valves.
   2. Mount schedules under plexiglass in the Mechanical Room.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Except as otherwise indicated on the Drawings or specified herein, the manufactured units and flow measurement devices shall be supplied one of the manufacturers listed under each item heading.

2.2 MATERIALS

A. System Freeze Protection: Refer to Division 23 for chemical freeze protection requirements.

2.3 PIPE AND FITTING APPLICATIONS:

A. General:
   1. Comply with the requirements of Division 23 Section “Copper Pipe and Fittings for HVAC.”
   2. Comply with Application requirements below.

B. Hydronic:
   1. For Piping Through 2-Inch to 60 psig:
      a. Pipe: Seamless Copper, Type L, ASTM 1388:
         1) Joints: 50/50 Solder.
         2) Fittings: Wrought Copper.
   2. For Piping 2-1/2-Inch and Larger to 60 psig:
      a. Pipe: Seamless Copper, Type L, ASTM 1388:
         1) Joints: 50/50 Solder.
         2) Fittings: Wrought Copper.

2.4 VALVES

A. Provide in accordance with Division 23 Section “General Duty Valves for HVAC.”

2.5 MANUAL AIR VENTS

A. Manual air vents shall be 3/4" ball valve and comply with the requirements of Division 23 Section “General Duty Valves for HVAC”.

2.6 MANUFACTURED UNITS

A. Throttling and Shutoff Valves:
   1. 125 psi at 250 degrees F.
   2. Furnish with adjustable memory stop on all throttling applications.
   3. Comply with the requirements of Division 23 Section “General Duty Valves for HVAC.”

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Install piping and circulation system in accordance with:
      a. The Drawing.
      b. These Specifications.
      c. The Shop Drawings reviewed by Engineer.
      d. The Manufacturer's recommendations.
   2. System shall not interfere with passage, head room or openings of doors and windows.
   3. Pipe: Straight, without rust or other defects.
4. Joints:
   a. Welded: Required for pipes 2-1/2 inches and larger.
   b. Screwed:
      1) Reamed after cutting and before threading.
      2) Sharp, clean threads.
      3) Use pipe compound on male threads only.

B. Mains and Branches:
   1. Install above the ceiling and in bar joists, above bottom chord, as indicated on the Drawings.
   2. Sizes as indicated on the Drawings.
   3. Install Tops of Mains Level:
      a. Use eccentric fittings at changes in pipe size.
      b. Provide adequate supports to prevent air pockets.
   4. Branches:
      a. Take off bottom of main.
      b. Provide swing connection before vertical riser to a heating unit or convector.

C. Risers and Vertical Pipes: Plumb, straight and without unnecessary fittings or offsets.

D. Fittings:
   1. Provide Air Vents:
      a. As indicated on the Drawings.
      b. At all high points on the system.
   2. Provide Drain Valves:
      a. At the bottom of all risers.
      b. At all low points.
      c. As indicated on the drawings.
   3. Provide insulating couplings or unions where copper and steel pipes are joined.
   4. Provide unions at all valves and at all equipment for making repairs.

E. Valves:
   1. Provide Shutoff Valves:
      a. On all branches at the main.
      b. So that equipment can be serviced without shutting down the system.
   2. Provide unions at all valves and at all equipment for making repairs.

END OF SECTION 23 21 13
SECTION 23 21 23 – HYDRONIC PUMPS

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 furnishing and installation of the HVAC pumps.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. American Society of Mechanical Engineers (ASME): B31.9 - Code for Building Services Piping.
   2. Underwriter's Laboratories, Inc. (UL).

1.4 SUBMITTALS

A. Manufacturer's Literature: For each pump.
   1. Pump make and model designation.
   2. Pump efficiency at design:
   3. Dimensions.
   4. Total head at design.
   5. Shut off head.
   6. Required NPSH at design.
   7. Motor Manufacturer, type and characteristics.
   8. BHP required at design conditions.
   11. Project specific wiring diagrams including control wiring.

B. Operation and Maintenance Manuals: For each pump.
   1. Equipment function, normal operating characteristics and limiting conditions.
   2. Assembly, installation, alignment, adjustment and checking instructions.
   3. Operating instructions for start-up, routine and normal operating, regulation and control, and shutdown and emergency conditions.
   4. Lubrication and maintenance instructions.
   5. Guide to "troubleshooting".
   6. Parts lists and predicted life of parts subject to wear.
   7. Outline, cross-sections, assembly drawings, engineering data and wiring diagrams.
   8. Test data and performance curves.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

1.6 DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered in original, unbroken, brand marked containers.

B. Handle and store materials in a manner which will prevent deterioration and contamination with foreign matter.
C. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace removed materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Bell & Gossett.

B. Armstrong Pumps, Inc.

C. Aurora.

D. Taco.

2.2 MANUFACTURED UNITS

A. Base-Mounted Pumps:
   1. Base-mounted, single-stage, end suction design with true back pull-out.
   2. Pump Volute: Class 30 cast iron with integrally-cast pedestal support.
   3. Impeller:
      a. Case bronze.
      b. Enclosed type.
      c. Dynamically balanced.
      d. Keyed to the shaft and secured by a locking capscrew.
   4. The liquid cavity shall be sealed off at the pump shaft by an internally-flushed mechanical seal with ceramic seal seat of at least 98% alumina oxide content, and carbon seal ring, suitable for continuous operation at 250 degrees F.
   5. A replaceable stainless steel shaft sleeve shall completely cover the wetted area under the seal.
   6. Rated for minimum of 175 psi working pressure.
   7. Casings:
      a. Gage ports at nozzles.
      b. Vent and drain ports at top and bottom of casing.
   8. Pump Bearing Housing Assembly:
      a. Heavy-duty regreaseable ball bearings, replaceable without disturbing piping connections.
      b. Foot support at coupling end.
   9. Base Plate: Structural steel or fabricated steel channel configuration fully enclosed at sides and ends, with securely welded cross members and fully open grouting area.
   10. A Flexible-Type Coupler:
       a. Capable of absorbing torsional vibration.
       b. Between the pump and motor.
       c. Equipped with a suitable coupling guard as required.

2.3 COMPONENTS

A. Motors: Comply with the requirements of Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.4 SOURCE QUALITY CONTROL

A. Factory align and run test pumps.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install pumps in conformance with:
   1. The Drawings.
   2. These Specifications.
   3. The Shop Drawings reviewed by Engineer.
   4. The Manufacturer's recommendation.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Arrange and pay for Manufacturer's engineer to provide the services indicated below. Schedule the following as soon as practicable after installation, and at times approved by Engineer and Owner.
   1. Manufacturer's Engineer: Check work, assist in start-up, demonstrate operation and maintenance to Owner's personnel, and review operation and maintenance manual with Owner's personnel.

B. Promptly make all changes and additions required by Manufacturer's engineer.

END OF SECTION 23 21 23
SECTION 23 22 13 – STEAM AND CONDENSATE PIPING

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 furnishing and installation of the steam and condensate piping systems.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. American Society of Mechanical Engineering (ASME):
      b. B31.9 - Building Services Piping.
      d. Heating Boiler Code.

1.4 SUBMITTALS

A. Shop Drawings: For all pressure reducing stations.
   1. Dimensions.
   2. Construction and installation details.
   3. Performance criteria, including valve Cv.
   4. Manufacturer/model number.

B. Manufacturer's Literature: For all traps, vents, vacuum breakers and steam control valves.
   1. Manufacturer/model number.
   2. Size and capacity (Cv).

C. Drip and Trap Circuit Layout Drawings: Submit for Engineer's and Owner's review, a dimensional layout drawing for all trap circuits. Drawings shall be to scale and may be 3-dimensional or include sufficient section cuts to indicate spatial relationships of steam and condensate piping, drip legs, bleeder, and valve orientation.

1.5 QUALITY ASSURANCE

A. Qualifications: All welders shall be certified per the requirements of ASME B31.1 and B31.5, as applicable.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. As indicated on the Drawings.

B. Provide in accordance with the requirements of Division 23 Section "Steel Pipe and Fittings for HVAC" and as follows:
   1. Steam – To 60 psig – Above Ground:
      a. For Piping Through 2-Inch:
         1) Pipe: Black Steel, Schedule 40, ASTM A53, ERW or seamless, Grade B.
         3) Joints: Screwed.
Steam and Condensate Piping

Wayne State University
Prentis Building Computer Lab Relocation
WSU Project Number 022-313456
FTCH Project Number 180746

2. Steam Condensate Piping

2.1 STEAM PIPING

b. For Piping 2-1/2-Inch and Larger:
   1) Pipe: Black Steel, Schedule 40, ASTM A53, ERW or seamless, Grade B, standard weight for 12-inch and above.

2.2 VALVES

2.3 STEAM TRAPS

A. Manufacturers:
   1. Armstrong Machine Works:
   2. Spirax-Sarco.
   3. [ Watson-McDaniel. ]
   4. [ ITT Hoffman. ]
   5. [ Steamgard. ]
   6. [ Bestobell. ]

B. Float and Thermostatic: Cast semi-steel, 125 psi class body, seamless copper or stainless steel float, stainless steel valve heads and seats.

C. Trap Universal Connector:
   1. Traps shall be mounted to 360 degree universal connector able to accept multiple manufacturer thermostatic and bimetallic steam trap models.
   2. Manufacturers: Armstrong, Spirax Sarco; or equal.

2.4 VACUUM BREAKERS

A. Provide manufactured unit supplied by Manufacturer listed above similar to Hoffman No. 62.

B. Alternately, use check valve with opening force of 3-inch W.G. or less complying with the requirements of Division 23 Section “General Duty Valves for HVAC.”

2.5 STEAM CONTROL VALVES

A. Refer to Division 23 Section “General Duty Valves for HVAC.”
PART 3 - EXECUTION

3.1 INSTALLATION

A. Piping:
1. All piping shall be installed in such a way that it will be free to expand and contract, without noise, or damage to itself or to the building. It shall be the duty of this Contractor to prevent others from altering this purpose.
2. All piping shall be installed in such a manner that it will NOT interfere with the necessary passage, head room or opening of doors or windows.
3. Risers and vertical pipe shall be plumb, straight and have no unnecessary fittings or offsets.
4. Filings, dust, or dirt shall be wiped from interior of the pipe or tubing before connections are made.
5. Changes in direction shall be made with fittings.
6. Vent pipes shall be installed through the roof as directed and shall be flashed as specified.
7. Pitch:
   a. Horizontal supply mains shall pitch up in the direction of flow.
   b. The grade shall be not less than 1-inch in 40 feet.
8. Reducing fittings shall be used for changes in pipe sizes, eccentric, flat on bottom.
9. Open ends of pipelines and equipment shall be capped or plugged during installation to keep dirt or other foreign materials out of the systems.
10. Pipe not otherwise specified shall be uncoated.
11. Connections between ferrous piping and copper piping shall be electrically isolated from each other with dielectric unions.
12. Branch connections for steam and condensate shall be taken off mains on top, up at a 45 degree angle, or horizontal.

B. Steam Traps:
1. Install with union or flanged connection at both ends.
2. Provide gate valve and strainer at inlet, gate valve (and check valve) at discharge.
3. Provide minimum 10-inch (250 mm) long dirt pocket of same pipe size as apparatus return connection.
4. Do not install thermostatic elements in traps until system has been operated and dirt pockets cleared of sediment and scale. Provide temporary covers for use prior to this time.
5. Install for proper drainage of all low points of piping and equipment.
6. If orifice types are used, all traps shall be orifice type, with the exception of apparatus with constant steam pressure but variable loads (i.e., steam coil with face and bypass damper). Provide Y-type strainer with 40 MESH stainless steel insert upstream of all orifice traps.
7. All trap circuits in tunnels must be installed to provide full access to all components and connections for service and system maintenance. Layout must also minimize risk from contact with hot piping, valves and blow-offs. Refer to submittal requirements.

C. Vacuum Breakers:
1. Vacuum breakers shall be installed on all tank heaters, jacketed kettles, converters, coils and similar apparatus where a possibility of damage may occur because of high vacuum.
2. Vacuum breakers shall be installed above the highest fixtures it is protecting as required by codes in such a manner that it will preclude back pressure.
3. Vacuum breaker shall be installed where it will be accessible for periodic testing and where spillage will not be objectionable.

3.2 INSPECTIONS

A. Inspections are the responsibility of the Owner and may be performed by employees of the Owner or party authorized by the Owner.

B. Prior to initial operation, the "Non-Boiler External Piping" installation shall be inspected to ensure compliance with the engineering design and with the material, fabrication, assembly, examination and test requirements of the Code.
3.3 EXAMINATIONS

A. Visual Examinations:
1. Visual examinations are to be performed by the fabricator, erector, or a party authorized by the Owner which include visual examinations and observations.
2. Visual examinations as defined are to be performed as necessary during the fabrication and erection of the piping components to provide verification that the design and WPS requirements are being met.
3. Visual examinations shall also be performed to verify that completed welds in pipe and piping components comply with the acceptance standards specified in the Code.
4. Personnel who perform nondestructive examinations of welds shall be qualified and certified for each examination method in accordance with a program established by the employer of the personnel being certified based on the Code requirements.
5. Owner may examine welds at structural supports and pipe attachment assemblies at their discretion.

3.4 PRESSURE TESTING

A. Hydrostatic Testing:
1. Provide complete hydrostatic testing for leaks of all piping systems in accordance with ASME B31.1 "Code for Pressure Piping," latest revision.
2. Test pressure shall be at least 1.5 the design pressure, but in no cases less than 150 psig.
3. Following the application of hydrostatic test pressure for at least 4 hours, examination shall be made for leakage of the piping and at all joints and connections.
4. If leaks are found, they shall be eliminated as appropriate, and the test repeated until no leakage is found.
5. Testing must be witnessed and approved by the Owner's representative on each section of pipe before insulating.

B. Pneumatic Testing:
1. May be used in lieu of hydrostatic testing only when necessary for conditions and pre-approved by Engineer.
2. Provide complete pneumatic testing for leaks of all piping systems in accordance with ASME B31.1 "Code for Pressure Piping," latest revision.
3. Apply not more than 25 psig for at least 10 minutes to identify major leaks.
4. Final test pressure shall be at least 1.5 the design pressure, but in no cases less than 150 psig.
5. Hold at full test pressure for a minimum of 10 minutes and gradually reduce to design pressure.
6. Following the application of pneumatic test pressure for at least 4 hours, examination shall be made for leakage of the piping and at all joints and connections using soap bubbles or other acceptable method to visually identify leaks.
7. If leaks are found, they shall be eliminated as appropriate, and the test repeated until no leakage is found.

C. Test Procedures:
1. Blank off or replace with spool pieces items of devices and equipment such as vessels, valves, instruments, etc. rated for pressure less than the test pressure. Reconnect equipment after testing.
2. Perform tests before piping is covered or concealed.
3. A pressure recorder shall monitor the testing of piping systems to verify test results.

D. Cycle Testing:
1. Following the completion of the leak testing procedures, the Contractor shall coordinate with the Owner's staff to conduct a cycle test on both the steam and condensate piping installed under this Contract.
   a. All testing shall be scheduled through the Owner's with a minimum of 72 hours notice.
   b. The cycle test may also be performed in conjunction with the in service test as authorized by the Owner.
   c. The Contractor shall be present while the cycle test is being conducted.
2. The cycle test shall consist of a single warm-up cycle and cool-down cycle where the systems are gradually brought up to normal operating pressure and temperature for a period of 8 hours.
3. Prior to beginning the test, the Contractor shall mark the position of the steam and condensate expansion joints and guides at ambient conditions.
4. The position of the expansion joints and guides shall also be marked after the system has been brought up to operating temperature and pressures.

5. Following the cool down period, and when the system has been cooled to ambient conditions, the Contractor shall visually inspect these components including pipe slide supports to ensure their return to the initially marked position. The Contractor shall note misalignment and failure of the system to return to the original position.

3.5 PROTECTION AGAINST FREEZING

A. At any time that any of the piping is full of water for testing purposes or otherwise prior to actual heated operation, the system shall be protected against freezing by the introduction of an acceptable anti-freeze which will be flushed out before acceptance. Provision for introducing anti-freeze shall be made by means of valved connections to the system in an acceptable manner.

3.6 CLEANING AND FLUSHING

A. Piping shall be cleaned before the installation, and flushed after the installation and before system start up.

B. Equipment, detergents, solvents and other cleaning agents shall be furnished by a qualified water treatment service.

C. Disconnect piping to be flushed. Remove instruments which may be damaged by the cleaning procedures. Such items shall be replaced with spool pieces, plugs, or blind flanges.

D. Before the piping is put in service, clean it using a pressure tank with a hose equipped with a nozzle to direct a high velocity stream of water against the inside wall of the pipe. Make a minimum of 2 passes through the pipe with the hose. A minimum pressure of 250 psi shall be developed at the nozzle.

END OF SECTION 23 22 13
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.

B. Refer to Division 23 Section “Hangers and Supports for HVAC Piping and Equipment” for ductwork and equipment.

1.2 SUMMARY

A. This Section includes the furnishing and installation of sheet metal ductwork and appurtenances:
1. As indicated on the Drawings.
2. As specified herein.
3. As required to provide a complete and operational air distribution system.
4. As necessary for the proper and complete performance of the Work.
5. Including all hangers, supports and anchors.

1.3 DESIGN AND PERFORMANCE REQUIREMENTS

A. Provide all hangers, supports, braces and connections as required to meet the seismic restraint requirements of International Building Code of 2015 and in accordance with the guidelines of the SMACNA Seismic Restraint Manual.

B. Comply with the requirements of Division 23 Section “Sound and Vibration Control for HVAC” for vibration isolation of ductwork.

1.4 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:

  1. ASHRAE Guidelines:
     b. 2001 Handbook - Chapter 34 - "Duct Design."
     c. ASHRAE 62.1, current version.
  2. ASTM Specifications:
     a. A480 - General Requirements for Flat-Rolled Stainless Steel and Heat-Resisting Steel Plate, Sheet, and Strip.
     b. A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
     c. A924 - General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
     d. B209 - Aluminum and Aluminum - Alloy Sheet and Plate.
  3. ASTM Standard Test Methods:
     a. A90 - Weight of coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
     b. C731 - Extrudability, after Packaging, Aging, of Latex Sealants.
     c. D2202 - Slump of Sealants.
  4. NFPA Standards:
     a. 90A - Installation of Air Conditioning and Ventilating Systems.
     b. 90B - Installation of Warm Air Heating and Air Conditioning Systems.
  5. SMACNA Guidelines:
     b. "Rectangular Industrial Duct Construction Standards."
     c. "Round Industrial Duct Construction Standards."
     d. "Guide for Steel Stack Construction."
6. UL Standards: 181 - Factory Made Air Ducts and Connectors.

1.5 SYSTEM DESCRIPTION

A. Duct sizes indicated on Drawings are net clear inside dimensions.

B. Duct Construction Pressure Classifications:

<table>
<thead>
<tr>
<th>Duct System</th>
<th>SMACNA Pressure Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Supply duct downstream of VAV terminals</td>
<td>1&quot; W.G.</td>
</tr>
<tr>
<td>2. Supply duct upstream of VAV terminals</td>
<td>3&quot; W.G.</td>
</tr>
<tr>
<td>3. Return duct</td>
<td>-1&quot; W.G.</td>
</tr>
</tbody>
</table>

1.6 SUBMITTALS

A. Manufacturer's Data: Sequential parts list for each part.
1. Name of Manufacturer.
2. Part name and model number.
3. Dimensions.

B. Shop Drawings: Construction details for special fabricated parts.

C. Duct Pressure Test:
1. Written procedure for leak testing installed supply, and return ductwork system 30 days prior to testing.
2. Duct pressure test report.

1.7 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
1. Trained and experienced in the fabrication and installation of the materials and equipment.
2. Knowledgeable of the design and the reviewed Shop Drawings.

B. Regulatory Agencies Requirements:
1. All state and local codes and ordinances.
2. Owner's insurer.
3. Flexible ductwork shall comply with:
   a. UL listed - Class 1 Air Duct Material, Standard 181.
   b. NFPA Standard 90A - Flame spread: 25, Smoke developed: 50.

1.8 DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter and damage by weather or elements in accordance with Manufacturer's directions.

C. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Duct Connection Systems:
1. Ductmate Industries, Inc.
2. Lindab, Inc.
B. Flexible Duct:
   1. Flexmaster USA, Inc., Type 3 uninsulated or 3M insulated as specified.
   2. General Environment Corporation.
   3. Wiremold Company.

C. Prefabricated Fittings:
   1. United McGill Corporation.
   2. Buckley Air Products, Inc.
   3. Eastern Sheet Metal, Inc.
   4. LaPine Metal Products.
   5. Lindab, Inc.
   7. Universal Spiral Air.

D. Manufactured ductwork and fittings shall be of one Manufacturer to ensure tight fit of ductwork and components.

E. Manufacturer's Stamp:
   1. Manufacturer's stamp shall be on the outside of the ductwork.
   2. Stamp shall be clean and clear, indicating the metal gage.

2.2 MATERIALS

A. Galvanized Steel:
   1. Galvanized steel of lock-forming quality with minimum ASTM A653, G90 zinc coating, both sides in accordance with ASTM A90.
   2. Use for all ductwork systems unless noted otherwise.

B. Acceptable Fasteners:
   1. Rivets, bolts, or sheet metal screws.
   2. Stainless steel.

C. Tapes:
   1. High pressure rated, non-hardening, water resistant and fire-resistant.
   2. Compatible with duct material.

D. Sealants:
   1. Fire and Smoke Hazard Rating:
      a. As tested by ASTM E84, NFPA 255, or UL 723.
      b. Not to exceed: Flame spread 25, smoke developed 50.
   2. Exterior Mastic Sealant: Certified to pass 600 hours QUV; or equivalent weather testing.
   3. Comply with ASTM C731 and D2202.
   4. Specifically formulated for sealing the field joints.
   5. UL listed.
   7. Foster 32-19 Duct Fas, 32-17 Safetee, 32-14 High Velocity Duct Sealant.
   8. Childer CP-146, Chil Flex C—147.

E. Hangers:
   1. Galvanized steel band iron.
   2. Rolled angle and 3/8-inch minimum galvanized steel rod.

F. Wall Supports:
   1. Galvanized steel band iron.
   2. Fabricated angle bracket.
G. Vertical Supports at Floors:
   1. Rolled steel angle 1-1/2 x 1-1/2 x 1/8 minimum.
   2. Mechanically attached to duct.

2.3 FABRICATION

A. General: Construct rectangular, round and flat oval ductwork and fittings in accordance with the SMACNA HVAC Duct Construction Standards, Metal and Flexible, current edition.

B. Transitions: Make every change in size or shape of duct with taper not exceeding 20 degrees.

C. Connections:
   1. Make connections to equipment as indicated on Drawings or called for by these Specifications.
   2. For rectangular connections, crimp fabric to sheet metal and fasten sheet metal to ducts by screws 2-inch on center.
   3. Flexible Ductwork Connections:
      a. Securely fasten flexible duct to round sheet metal ducts or duct collars with stainless steel or zinc-coated iron draw bands with worm gear fastener.
      b. Flexible duct 10-inch diameter or less, installed on 1-inch W.G. pressure classification duct may be attached with nylon cable ties.
      c. Fabric shall not be stressed other than by air pressure.

D. Elbows and Tees:
   1. Maintain centerline radius of 1-1/2 times duct width in plane of turn wherever possible.
   2. Provide short radius fittings with a minimum of 2 turning vanes full length of turn or square elbows with multiple blade airfoil turning vanes set at 45 degree angle.

E. Turning Vanes and Distribution Devices: Where registers, grilles or diffusers are located less than 5 equivalent duct diameters from the main duct, provide necessary distribution grids or turning vanes to ensure even distribution of air over the entire face of the outlet.

F. Provide necessary plastering frames and drawbands required.

G. Branch Ducts:
   1. Construct with full radius elbow turning into a transition section in the main duct.
   2. Provide with damper and quadrant as specified in Division 23 Section “Dampers.”

H. Mixing Boxes:
   1. Modify, by experimentation if necessary, the return and outdoor air mixing section of duct if nuisance tripping of freeze-stat occurs due to inadequate mixing of airstreams.
   2. Install sheet metal baffle plates to promote mixing and eliminate stratification.

2.4 MANUFACTURED UNITS

A. Turning Vanes:
   1. Hem the leading edge of vanes in ducts over 20-inch width with 1/2-inch fold-back.
   2. Reinforce turning vanes in ducts over 24-inch diameter with rods or sectional construction to limit unsupported length to 24 inches.
   3. 24 gage, minimum.
   4. Use in rectangular elbows with R/D ratio of less than 1.5.
   5. Double wall.

B. Bellmouth Fittings:
   1. Use spun bellmouth connections at each round take-off from the high pressure plenum.
   2. Manufactured spun Bellmouth fittings may be used in lieu of take-offs indicated on Drawings: Buckley Air Products Type BM; or equal.
C. Takeoffs from Round 1-inch Pressure Classification Duct:
1. Made with factory fabricated lateral type fittings.
2. At an angle of no more than 45 degrees.
3. As manufactured by United McGill Corp., Model SRL; or approved equal.
4. In accordance with detail on Drawing.

D. Flexible Duct:
1. Construction:
   a. Liner of laminated aluminum foil/fiberglass/aluminated polyester.
   b. Zinc-coated steel helix bonded to liner.
   c. 1-inch thick, 1 pound/cubic foot insulation.
   d. Seamless copolymer vapor barrier jacket.
   e. Rated for pressure class of system in which duct is used.
2. Maximum flexible duct length shall not exceed 5 feet, maximum flex duct turn not to exceed 45 degrees.

E. Manufactured Ductwork Connection Systems:
1. General:
   a. In lieu of SMACNA Duct Construction Standards, Contractor may use an alternative engineered
      connection system such as Ductmate, “Spirosafe” by Lindab; or approved equal.
   b. Designed to provide equivalent reinforcing and pressure characteristics.
2. Description:
   a. Duct, gasket, and fitting providing an airtight outer pressure shell.
   b. The construction shall have mechanical means to maintain positive or negative pressure
      requirement, or both, and rigidity equivalent to SMACNA joints and metal gages.
3. Duct Material:
   b. Metal Gage: As required to meet pressure classification indicated.
4. Fittings:
   a. As indicated on Drawing and of same Manufacturer as duct section.
   b. Sized to slip fit into the duct sections, without sharp projections for noise and airflow disturbances.

2.5 DUCT ACCESS DOORS

A. Manufacturers:
1. Prefco.
2. Pottorff.

B. Provide In Ductwork:
1. As indicated on the Drawings.
2. Wherever necessary for proper access to instruments, controls, fire dampers, motorized dampers, coils
   and equipment.
3. For convenient inspection, maintenance and replacement.
4. Reinforce openings on sides with material or ductwork in which doors are installed.

C. Construction:
1. Two-piece 22 gage minimum pan construction, consisting of outer side crimped over inner dished side.
2. Continuous piano hinge and not less than 2 heavy cam latches. A removable type door is acceptable
   only where there is inadequate clearance for a hinged door.
3. Contact surfaces of doors covered with heavy dense felt securely fastened in place to make doors air
   tight.
4. Insulated or soundproofed with same materials as ducts or casings where located.
5. Ruskin ADH22 or ADC22; or equal.
2.6 SOURCE QUALITY CONTROL

A. Certified Testing:
   1. Suppliers of manufactured round and oval ductwork shall have on file with Engineer certified copies of test data made by an independent United States laboratory covering pipe and fittings as manufactured by that Supplier.
   2. Spiral Pipe Test Data:
      a. Cover leakage rate, bursting strength, collapsing strength, seam strength and friction loss.
      b. Friction loss test data shall cover both the duct and the assembled coupling joints.
      c. This friction loss data shall be equal to or less than the friction loss data used in the design of this system.
   3. The fitting test data shall cover the friction loss tests of all fittings used on the project.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Install ductwork and accessories to provide a system free from buckling, warping, breathing, vibration, rattling, or whistling.
   2. Lap ducts in direction of air flow with longitudinal seams locked and hammered tight.
   3. Provide flat “S” cleats on all exposed traverse duct connections in finished areas.
   4. Install ducts straight with building walls where possible and exposed duct tight against roof or walls where possible.
   5. Ducts shall be air-tight, rigid, securely hung or bracketed in position.
   6. At the end of an uninsulated section or run, where internally insulated duct connects to uninsulated spiral duct or fitting, fire damper or flex, install an insulation end fitting to bring the outer shell down to nominal size.
   7. Install screws and rivets of such length that they do not interfere with the operation of manual or automatic dampers.

B. Protection of System:
   1. Cap the ends of sheet metal ductwork, including the roof openings, registers and diffuser openings with temporary durable air-tight and water-tight covers during all stages of construction in order to keep system clean.
   2. If permanent heating and cooling equipment is used prior to Substantial Completion, protection of ductwork systems shall comply Division 23 Section “General HVAC Provisions.”

C. Hanging Duct:
   1. Allow swing in long direction of duct for movement.
   2. Double nut hanger rods.

D. Duct Anchoring:
   1. Galvanized sheet metal hanger straps attached to construction.
   2. Angle metal screwed to the ductwork.

E. Turning Vanes:
   1. Use in rectangular mitered elbows with R/D ratio of less than 1.5 and elsewhere as indicated.
   2. Install evenly spaced along elbow diagonal with leading and trailing edges aligned to sides of duct.
   3. Install vanes on 3-3/4-inch centers.
   4. Elbows Where Duct Changes Size:
      a. Mount vanes individually (not on premanufactured vane runners).
      b. Ensure that leading and trailing edges align parallel to sides of duct.

F. Exterior Ductwork: Refer to SMACNA Guidelines specified in Paragraph 1.3.A.5.a, Pages 5-6, 5-7, and 5-8 for requirements of construction and installation.
G. Joint Sealing of Duct Systems:
1. Except where using gasketed duct connection systems, seal ductwork in accordance with SMACNA Class A:
   a. Seal ductwork including supply, return, mixed, outdoor, and exhaust air systems.
   b. For Round and Flat Oval Ductwork:
      1) Apply approved sealant to the male end of the couplings and fittings.
      2) After the joint is slipped together, place sheet metal screws 1/2-inch from the joint bead for mechanical strength.
      3) Apply sealer to the outside of joints including longitudinal joints, extending 1-inch on each side of the joint.
      4) Cover screw heads.
   c. For Rectangular Ductwork:
      1) Apply approved sealant to transverse and longitudinal joints.
      2) Extend sealant a minimum of 1-inch on each side of joint.
   d. Follow sealant Manufacturer’s directions for application, storage and cure time.
   e. Ductwork located outside shall be air and watertight.
2. Manufactured Connection Systems:
   a. Acceptable in accordance with Paragraph 2.1.
   b. Seal flanged joints with neoprene rubber gaskets.

H. Appearance: Where exposed ducts pass through walls or floors: Refer to Division 23 Section “Penetrations for HVAC.”

3.2 HANGING AND SUPPORT

A. All Ducts:
   1. Support in a secure manner.
   2. Subject to Engineer’s approval.

B. In accordance with Chapters 5 and 6 of the SMACNA HVAC Duct Construction Standards.

C. Do not support ductwork from metal roof deck.

D. Unacceptable work shall be removed and replaced at no additional cost to Owner.

3.3 FIELD QUALITY CONTROL

A. Duct Systems to be Tested:
   1. Supply ducts.
   2. Return ducts.
   3. Exhaust ducts. [ Exhaust ducts connected to Fans EF-1, etc. ]
   4. Outdoor air intake ducts.

B. Pressure Testing:
   1. Pressurize the installed duct system to a test pressure 50% over the designated SMACNA pressure classification.
   2. Measure air leakage at the test pressure by an orifice type of flow meter which has been individually calibrated against a primary standard and this calibrated curve permanently attached to the orifice tube assembly.
   3. If the system is tested in sections, add the leakage rates to give the performance of the whole system.
   4. Total allowable leakage of the system shall not exceed 2.5% of the air handling capacity of the system.
   5. Correct Objectionable Noise:
      a. Even if the system passes the leakage rate criteria.
      b. To the satisfaction of Engineer.
   6. Apply duct tape over sealed joints prior to testing, if the system is to be tested before the recommended sealer curing time has elapsed.
C. Perform testing in accordance with a printed procedure reviewed by Engineer.

D. Notify Engineer 1 week prior to duct pressure test to allow Engineer the option to be available to observe testing.

E. Pressurization Control:
   1. Protection against duct overpressurization or underpressurization during testing is the responsibility of Contractor.
   2. Verify that control, variable air volume, balancing, and fire dampers are open.
   3. Verify that pressure relief panels or controls are operational.
Metal Ducts

Section 23 31 13

END OF SECTION 23 31 13
SECTION 23 33 13 – DAMPERS

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, but is not limited to, the major items listed below:
1. Fire dampers.
2. Airflow regulating dampers.

B. Division of Work:
1. In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the Work to be performed by specific trades.
2. The following are suggestions as to how the Work may be divided. This is not a complete list of all the Work:
   a. Mechanical Subcontractor:
      1) Install control dampers.
      2) Provide manual dampers and gravity backdraft dampers.
   b. Temperature Control Subcontractor:
      1) Furnish control dampers, linkages and operators unless specifically noted otherwise on Drawings.
      2) Install linkages and operators on dampers.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the Work of this Section shall comply with the following:
2. SMACNA Publications:
   b. HVAC Duct Construction Standards - Metal and Flexible.
3. ASTM:
4. UL:
   a. 555 - Fire Dampers.
   b. 555C - Ceiling Dampers.

1.4 SUBMITTALS

A. Manufacturer's Literature:
1. Submit For:
   a. Fire dampers.
   b. Airflow regulating dampers.
   c. Duct access doors and panels.
2. Required Information:
   a. General:
      1) Dimensions.
      2) Details of construction and installation.
      3) Name of Manufacturer.
      4) Model.
3. Equipment function, normal operating characteristics and limiting conditions.
4. Assembly, installation, alignment, adjustment and checking instructions.
5. Operating instructions for start-up, routine and normal operating, regulation and control, and shutdown and emergency conditions.
7. Guide to "troubleshooting."

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
1. Trained and experienced in the fabrication and installation of the materials and equipment.
2. Knowledgeable of the design and the reviewed Shop Drawings.

B. Regulatory Agencies Requirements:
1. UL: Fire dampers shall conform to UL 555 and bear the UL label.
2. Installation and materials shall be in accordance with:
   a. All state and local codes and ordinances.
   b. Owner's insurer.

1.6 SEQUENCING AND SCHEDULING

A. Installation of control components at the Manufacturer's factory or in the field is optional only to the extent that schedule is not adversely affected.

PART 2 - PRODUCTS

2.1 AIRFLOW REGULATING DAMPERS

A. Manufacturers:
1. Dampers:
   a. Greenheck
   b. Air Balance
   c. American Warming and Ventilating, Inc.
   d. Perfco

B. Provide accessible, manually operable dampers:
1. At branch duct take-offs.
2. At diffuser run-out take-offs.
3. As indicated on the Drawings by the manual balancing damper ("B.D.") symbol.

C. Dampers for Round Duct:
1. For 8-inch and smaller, premanufactured dampers equal to Hart & Cooley 608/66 series.
2. Field Fabricate Dampers:
   a. Blade:
      1) Galvanized steel.
      2) Two gages heavier than duct in which installed.
   b. Pivot rod continuous, 3/8-inch minimum for 12 inches and larger, 1/4-inch for under 12-inch size.
   c. Hardware:
      1) For dampers less than 12 inches round, provide a dial regulator set consisting of 1 dial regulator, 1 square end bearing and 1 spring end bearing; equal to Durodyne set No. KS-145 or KS145L.
      2) For dampers larger than 10 inches round, provide a dial regulator set consisting of 1 dial regulator, 1 square end bearing and 1 spring end bearing equal to Duorodys Set No. KSR-195 or KSR-195L.
D. Dampers for Rectangular Duct:
    1. Field Fabricate Single Blade Dampers:
       a. Blade:
          1) Galvanized steel.
          2) Two gages heavier than duct in which installed.
          3) 12-inch maximum height.
       b. Pivot Rod:
          1) 3/8-inch pins up to 18-inch wide.
          2) 1/2-inch continuous rod over 18-inch wide.
    2. Dampers with Vertical Dimension Over 12 Inches:
       a. Use opposed blade type.
       b. Blade:
          1) 18-gage minimum galvanized steel.
          2) 12-inch maximum blade height.
          3) Hardware.

E. Regulator:
    1. Quadrant type with handle and wingnut.
    2. Provide with integral insulation flange or standoff for installations on insulated ductwork.
    3. Provide end bearing.
    4. Equal to Duro Dyneset KS-12.

2.2 FIRE DAMPERS

A. Manufacturers:
   1. Air Balance.
   2. American Warming.
   4. Perfco.

B. General Requirements:
   1. Fusible link actuated.
   2. Type B, 100% minimum free duct area with blade out of airstream.
   3. Installation of Type “A” fire dampers in an oversized duct is not an acceptable substitute for Type “B”.
   4. UL Classified Fire Resistance Rating: 1-1/2 hours.
   5. Size dampers at grilles same size as grille unless otherwise noted.

C. Provide where indicated on the Drawings and at code required locations in rated walls, floors and roofs.

D. Test fire dampers in accordance with:
   1. UL Standard 555 or;
   2. A nationally recognized, qualified testing laboratory approved by the local authority:
      a. Bearing the approved label of that laboratory.
      b. Installed in accordance with test installation.
   3. Test and label fire dampers for Dynamic Systems

2.3 INSTRUMENT TEST HOLES

A. Manufacturer: Ventlock Model 699; or equal.

B. Provide at control points including but not necessarily limited to:
   1. Air temperature controller sensors.
   2. Pressure sensors.
   3. Temperature limit devices.
   4. Locations determined by Test and Balance Engineers.

C. Compatible with duct external insulation thickness.
PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Install duct accessories in conformance with:
      a. The Shop Drawings reviewed by Engineer.
      b. SMACNA HVAC Duct Construction Standards and Fire, Smoke and Radiation Damper Installation Guide.
      c. These specifications where different from SMACNA.
      d. Manufacturer's written instructions.
   2. Locate branch dampers used for air flow regulation as close as possible to main trunks.
   3. Dampers shall not rattle or generate airborne noise of any kind regardless of damper position.
   4. Dampers located upstream of coils shall not interfere with uniform velocity profile at coil face.
   5. Locate and orient duct accessories according to Manufacturer's instructions relative to nearby fittings, elbows, and fans.
   6. Verify that dampers move freely through their entire stroke without binding.

B. Access:
   1. Concealed duct accessories requiring inspection, service or maintenance shall be accessible.
   2. Provide acceptable means of access.
   3. Ensure that damper operator handles are not covered by insulation.

3.2 IDENTIFICATION

A. Provide red stencil label on access doors to fire dampers that reads "fire damper".

B. Where fire dampers are located above accessible ceilings, provide a cadmium plated screw with its head painted red in the ceiling below the damper.

END OF SECTION 23 33 13
SECTION 23 36 00 – 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 furnishing and installation of all variable air volume (VAV) terminal units.

B. Cash Allowances: Work listed below to be completed by the temperature control system (T.C.S.) Subcontractor will be paid for from a cash allowance as specified in Division 01 Section “Cash Allowances” and performed by a T.C.S. contractor selected by Engineer.

C. Division of Work:
   1. In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the work to be performed by specific trades.
   2. The following are suggestions as to how the Work may be divided. This is not a complete list of all the work:
      a. General Contractor:
         1) Install access hatches for terminal units:
            a) As directed by Mechanical Subcontractor.
      b. Mechanical Subcontractor:
         1) Furnish all access doors:
            a) As required for access to concealed terminal units.
         2) Coordinate with General Contractor for access hatch locations and installation.
         3) Furnish and install VAV terminal units in ductwork system and provide hangers and support.
      c. Temperature Control Subcontractor:
         1) Provide control components:
            a) Furnish to VAV terminal unit Manufacturer.
            b) Complete field installation and calibrate.

1.3 SYSTEM DESCRIPTION

A. General:
   1. The assemblies shall be pressure independent and be able to reset to any airflow between 0 and a maximum cataloged cfm.
   2. Devices using cfm limits are not acceptable.
   3. Units shall be capable of morning warm-up operating control sequence.

B. Design and Performance Requirements:
   1. Air leakage less than 2% at 0.5 inches w.c. static pressure.
   2. Space NC less than 35 at 2000 fpm inlet velocity.

1.4 SUBMITTALS

A. Shop Drawings: For all terminal units.
   1. General:
      a. Dimensions.
      b. Details of construction and installation.
      c. Name of Manufacturer.
      d. Model.
   2. For Each Unit:
      a. Identify by schedule Tag No.
      b. Air pressure drop at maximum position for specified airflow.
      c. Acoustic data at specified maximum and minimum airflows.
d. Coil performance data.
e. Electrical characteristics and project specific wiring diagrams including controls wiring.

B. Operation and Maintenance Manuals: For each type of VAV terminal unit.
   1. Equipment function, normal operating characteristics and limiting conditions.
   2. Assembly, installation, alignment, adjustment and checking instructions.
   3. Operating instructions for startup, routine and normal operating, regulation and control, and shutdown and emergency conditions.
   4. Lubrication and maintenance instructions.
   5. Guide to "troubleshooting".
   6. Parts lists and predicted life of parts subject to wear.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

B. Regulatory Agencies Requirements:
   1. The entire unit including heating coils shall be UL listed and labeled.
   2. All insulation in accordance with:
      a. UL 181 for erosion.
      b. NFPA 90A for fire and smoke.
   3. Installation shall comply with:
      a. All state and local codes and ordinances.
      b. Owner's insurer.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate with sheet metal Subcontractor for scheduling of terminal unit installation so as to not delay the job.

B. Installation of control components at the Manufacturer's factory or in the field is optional only to the extent that schedule is not adversely affected.

1.7 WARRANTY

A. Warranty shall cover all component parts for a period:
   1. Not less than 36 months.
   2. Beginning from date of shipment.

B. Manufacturer shall bear all costs:
   1. For establishing and defining cause of unit's failure to perform as specified.
   2. For correcting or replacing all nonperforming units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Price Industries.

B. Titus.

C. Krueger.

D. Nailor Hart.

E. Siemen's ZCU.
Air Terminal Units

Section 23 36 00

2.2 MANUFACTURED UNITS

A. Casing:
   1. Minimum 22 gage galvanized steel.
   2. Internally Lined:
      a. 1-inch glass fiber.
      b. 4-pound duct density.
      c. Foil faced.
      d. Cut edges shall be scaled with metal barriers.
   3. Full bottom access door.

B. Damper:
   1. Galvanized steel or aluminum center pivot single blade or concentric sliding valve.
   2. Gasketed for positive closure.

2.3 COMPONENTS

A. Terminal Control Components - Electronic:
   1. Airflow Sensor and Transducer:
      a. Multi-point airflow pick-up to provide a factory piped differential pressure signal to an airflow transducer assembly.
      b. The pick-up shall maintain air accuracy of (+) 5% of the normal operating range of the terminal as a minimum.
      c. Integral flow taps and a calibration chart shall be provided with each unit.
   2. Terminal Damper Actuator - Electronic:
      a. Direct coupled actuator used to control the primary air damper of the terminal control unit.
      b. Constant current and torque limiting.
      c. The actuator shall be factory mounted, wired and installed by the terminal unit Manufacturer.
      d. Fully compatible with the electronic control signal for the T.C.S.
      e. The actuator shall be capable of providing a minimum of 35-inch pounds of torque.
      f. Capable of going from full open to full closed (or vise versa) in a maximum of 60 seconds.
   3. Terminal Box Controller Module: Refer to Division 23 Section "Instrumentation and Control for HVAC" for controller module requirements.

2.4 TERMINAL CONTROL UNIT POWER REQUIREMENTS

A. All air terminal units shall be designed for single point power connections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. As indicated on the Drawings.

B. In accordance with Manufacturer's installation instructions.

END OF SECTION 23 36 00
SECTION 23 37 00 – AIR OUTLETS AND INLETS

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 furnishing and installation of all air inlet and outlet devices.

B. Division of Work:
   1. In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the work to be performed by specific trades.
   2. The following are suggestions as to how the Work may be divided. This is not a complete list of all the work:
      a. General Contractor: Install stationary and adjustable louvers specified herein.
      b. Mechanical Subcontractor:
         1) Furnish stationary and adjustable louvers specified herein.
         2) Coordinate with General Contractor for proper louver installation.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. AMCA Publications:
      b. Standard 511 - Certified Ratings Program for Air Control Devices.

1.4 SUBMITTALS

A. Manufacturer's Literature: For all items specified herein.
   1. General:
      a. Dimensions.
      b. Details of construction and installation.
      c. Name of Manufacturer.
      d. Model.
   2. Performance at Scheduled Airflow:
      a. Maximum supply outlet throw value based on 50 fpm terminal velocity.
      b. Maximum air pressure drop in inches water gage.
      c. Maximum noise criteria (NC) level.
   3. Louvers:
      a. Performance Ratings:
         1) AMCA Certified.
         2) For Engineer's approval prior to fabrication.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.
PART 2 - PRODUCTS

2.1 REGISTERS, GRILLES, DIFFUSERS

A. Manufacturers:
   1. Price Industries.
   2. Titus.

B. General Construction Features:
   1. Refer to the Drawings for styles, types and design and materials.
   2. Return registers and grilles shall have fixed fins.
   3. Provide opposed blade, key operated dampers with registers.
   4. Provide sponge rubber gaskets at mounting flanges.

C. Finish:
   1. Manufacturer's standard paint.
   2. Off-white color for suspended ceiling installations.

D. Accessories:
   1. Provide where indicated or required.
   2. Equalizing grid.

E. Manufacturer/model numbers are scheduled on Drawings to indicate performance criteria, appearance style and quality of materials.

2.2 STATIONARY LOUVERS

A. Manufacturers:
   1. American Warming and Ventilating, Inc.
   2. Dowco.
   3. Louvers and Dampers, Inc.
   4. Ruskin.
   5. Greenheck.

B. General:
   1. Aluminum construction.
   2. AMCA certified for air performance and water penetration.

C. Components:
   1. 0.081-inch extruded channel frame.
   2. Blades:
      a. 0.081-inch extruded with intermediate rain stop.
      b. Provide front and back bar stiffeners on blades over 48 inches wide.
      c. Designed with drip trough for side runoff.

D. Size: As indicated on the Drawings.

E. Finish:
   1. Painted finishes: Furnished and applied by Manufacturer.
   2. Color: as selected by Architect.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Follow Manufacturer's instructions, subject to Engineer's approval.

B. Install registers, grilles and diffusers only after finish painting has been completed.

C. Install fixed vane return and exhaust grilles with angle of vanes perpendicular to normal line-of-sight.

3.2 ADJUSTING

A. Set pattern controllers on slot diffusers and set vanes on adjustable diffusers to provide air flow patterns as indicated on the Drawings.

3.3 PAINTING

A. Unlined Ductwork:
   1. Where visible behind registers, grilles and diffusers.
   2. Apply flat black paint:
      a. 2 coats.
      b. In accordance with Division 09 – Finishes.

B. Louvers:
   1. Where direct contact with steel occurs.
   2. Alkali-resistant bituminous paint or synthetic resin zinc chromate primer.
   3. Apply paint or primer to steel:
      a. Prior to installing louvers.
      b. As received from the Manufacturer without addition of thinner.
      c. In accordance with Division 09 – Finishes.

END OF SECTION 23 37 00
SECTION 23 40 00 – HVAC AIR CLEANING DEVICES

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, but is not limited to, the furnishing and installation of air cleaning devices:
   1. Disposable air filters.
   2. Filter housings.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   3. Underwriters Laboratories (UL):
      a. UL586 – High Efficiency, Particulate, Air Filter Units.
      b. UL867 – Electrostatic Air Cleaners.
      c. UL900 – Standard for Air Filter Units.

1.4 SUBMITTALS

A. Filter Schedule:
   1. List each filter application individually, including:
      a. Type(s) of filter(s) applied.
      b. Manufacturer and model number for each type used.
      c. List filters by size and quantity.

B. Manufacturer's Literature: For each separate installation.
   1. Dimensions.
   2. Name of Manufacturer.
   3. Model.
   4. Certified performance data.
      a. Efficiency.
      b. Air pressure drop at stated airflow.
   5. Filter frame materials of construction.

C. Cleaning and maintenance instructions.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. State and local codes and ordinances.
   2. Owner's insurer.
   3. UL listed and labeled Class 2.

1.6 DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered in original, unbroken, brand marked containers or wrapping as applicable.
B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter and damage by weather or elements in accordance with Manufacturer’s directions.

C. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. American Air Filter.

B. Camfil Farr Company.

C. Flanders.

D. Cambridge.

E. Fiberbond.

2.2 DISPOSABLE MEDIA FILTERS

A. Extended Surface, Pleated Filters:
   1. UL 900, Class 1, Non-woven pleated cotton and synthetic fabric bonded to a wire support grid.
   2. Beverage board enclosing frame with diagonal support members.
   3. Effective filter media shall not be less than 4.6 square feet of media per 1 square foot of filter face area.
   4. Nominal Size: 24 x 12 x 1-inch thickness.
   5. ASHRAE 52.2 Performance:
      a. MERV 8.
      b. 85% arrestance by weight.
      c. Initial resistance at 500 fpm face velocity: 0.20-inch WG.
      d. Final resistance at 500 fpm face velocity: 0.90-inch WG.

2.3 FILTER HOUSINGS:

A. Minimum 16-gage galvanized steel.

B. Two access doors with neoprene gaskets, full height hinges and tight sealing clamp type closures.

C. Extruded aluminum tracks or 14-gage minimum mounting grid designed to accommodate intended filters without leakage.

2.4 ACCESSORIES

A. Holding Frames:
   1. Compatible with filters.
   2. 16-gage minimum galvanized steel for disposable and pleated filters.
   3. Flush mitered corners.
   4. Filter racks shall be slide in style, requiring no supplemental clips, springs, or other hardware to maintain proper filter placement.

B. Differential Pressure Gage:
   2. Range: 0 to 2.0-inch water column.
   3. Size: 4-inch diameter dial readout.
   5. Connections: Use rubber hose to connect tips to gage.
2.5 SOURCE QUALITY CONTROL

A. Filter Housing:
   1. Leakage upstream to downstream of through housing shall be less than 1% at 3-inch WG differential.
   2. Leakage into housing from ambient shall be 0.5% or less at 3-inch WG negative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in such a manner as to prevent air leakage around filter/frame assembly.
B. Provide additional support for banks of frames over 3 frames high.
C. Calk around the perimeter of assembled frames.
D. Mount static pressure tips with angled end portion upstream.

3.2 SCHEDULE

A. Filter Applications:

<table>
<thead>
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<th>Air Cleaning Device</th>
<th>Units</th>
<th>Thickness</th>
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<td>Pleated Filter</td>
<td>HVAV-1</td>
<td>2&quot;</td>
<td>MERV 8</td>
</tr>
</tbody>
</table>

END OF SECTION 23 40 00
SECTION 23 65 13 – FORCED DRAFT COOLING TOWERS

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 furnishing and installation of accessories for evaporative cooling tower(s).

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASTM Standard:

1.4 SYSTEM DESCRIPTION

A. Provide cooling tower accessories as listed.

1.5 SUBMITTALS:

A. Shop Drawings: For each cooling tower.
   1. Dimensions.
   2. Details of construction and installation.
   3. Name of Manufacturer.
   4. Model.
   5. Size and location of all piping connections.
   6. Electrical characteristics and project specific wiring diagrams including controls wiring.

1.6 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

1.7 DELIVERY, STORAGE AND HANDLING

A. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, and damage by weather or elements in accordance with Manufacturer's directions.

B. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.
1.8 WARRANTY

A. Manufacturer: Provide extended coverage:
   1. Five years from date of purchase.
   2. For all mechanical equipment.
   3. Defects in materials and workmanship.

PART 2 - PRODUCT

2.1 EQUIPMENT

A. Cold Water Basin Heater: Basin heaters sized by manufacturer to maintain basin water at 40 deg.F (4.4 deg.C) at ambient temperature of -10 deg.F and wind velocity of 15 mph.
   1. Steam injection nozzle for each cold water basin for direct injection of steam into basin. Nozzle shall be Penberthy Model NWH steam injection nozzle with line size discharge pipe and all associated fittings required for a complete installation. Nozzles, piping, etc. shall be field installed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All materials and equipment shall be installed in accordance with Manufacturer’s recommended installation methods for obtaining conformance with the Contract Documents.

B. Manufacturer shall provide installation instructions.

C. Controls: Control single speed fan(s) by water temperature in return system.

D. Owner Training: Provide Owner training on the system maintenance requirements, including appropriate recommendations described in ASHRAE Guideline 12-2000, to minimize the risk of Legionellosis.

END OF SECTION 23 65 13
SECTION 23 74 43 – PACKAGED, INDOOR HEATING AND COOLING 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. Refer to Division 23 Section “Seismic and Wind Restraint Controls for HVAC” for seismic and wind restraint requirements related to this section.

1.2 SUMMARY

A. This Section includes the furnished and installation of packaged rooftop air handling unit(s).

1.3 SYSTEM DESCRIPTION

A. General:
   1. Factory assembled packaged unit suitable for roof-mounting and outdoor installation.
   2. All components functionally joined on a common base.
   3. Complete in every way, ready for electrical, ductwork, piping and control connections.

B. Major components include, but are not necessarily limited to, the following:
   1. Steam Heating section.
   2. Filter module.
   4. Economizer section.
   5. Compressor/condenser system with DX coil.
   6. Factory-mounted controls.
   7. 120 Volt GFCI receptacle.

C. Design and performance requirements as indicated on the Drawings.

1.4 SUBMITTALS

A. Shop Drawings: For complete unit.
   1. Manufacturer’s name and model number.
   2. Dimensioned Drawings:
      a. Unit plan and elevation.
   3. Size and Performance Data:
      a. Fans.
      b. Refrigeration equipment.
      c. Heating section.
      d. Cooling section.
   4. Details of construction and installation.
   5. Project specific electrical wiring diagrams including controls wiring.
   6. Control schematic.

B. Operation and Maintenance Manuals: For completed unit and individual components.
   1. Equipment function, normal operating characteristics and limiting conditions.
   2. Assembly, installation, alignment, adjustment and checking instructions.
   3. Operating instructions for start-up, routine and normal operating, regulation and control, and shutdown and emergency conditions.
   4. Lubrication and maintenance instructions.
   5. Guide to "troubleshooting".
   6. Parts lists and predicted life of parts subject to wear.
7. Outline, cross-sections, assembly drawings, engineering data and wiring diagrams.
8. Test data and performance curves.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

B. Manufacturer's Services:
   1. Provide start-up by factory-employed personnel of installed unit.
   2. Provide training for Owner's personnel.

C. Regulatory Organizations Requirements:
   1. All electrical wiring must comply with NEC.
   2. Comply with all applicable state and local codes and ordinances.

1.6 SEQUENCING AND SCHEDULING

A. Expedite approval of Shop Drawings so as not to delay unit installation.

1.7 WARRANTY

A. Provide extended warranty of 5 years total on all compressors from equipment startup.

B. Provide 25-year warranty on stainless steel heat exchangers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Trane.

B. York.

C. TMI Climate Solutions

D. Design is based on equipment as scheduled. Changes in equipment Manufacturer must meet minimum requirements listed in this Specification or on Drawings and be compatible with facility and intended use. Contractor shall be responsible for any additional costs caused by selection of equipment from the list of acceptable alternative Manufacturers, including any redesign efforts by the Engineer.

E. Note that a listing above as an acceptable Manufacturer does not imply that all Manufacturers listed can furnish equipment which complies with the requirements for each unit used on this project.

2.2 CABINET, CASING AND FRAME

A. Frame and Base Unit:
   1. 14 gage galvanized steel.
   2. Provide lifting brackets with lifting holes.

B. All cabinet walls, access doors and roof shall be fabricated of rigid, impact resistant, double wall, high performance composite panels with G90 galvanized steel on both sides (18 gage minimum) and a closed cell polyurethane foam interior core.
C. Foam shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929 for a minimum flash ignition temperature of 610 degrees F.

D. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, minimum 8 inches of positive or negative static pressure. Deflection shall be measured at the midpoint of the panel height and width.

E. Access: Access to filters, dampers, cooling coils, reheat coil, heaters, supply fans, exhaust fans, return fans, energy recovery wheels, compressors, water-cooled condensers, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.

F. Cabinet leakage rate shall not exceed 1% when tested at 6 inches of static pressure.

G. Sealants shall comply with EPA Method 24 40 CFR 59, Subpart D for VOC content.
   1. Metal to Metal: 30 g/L.
   2. Fiberglass: 80 g/L.

H. Insulation:
   1. All cabinet surfaces and access panels.
   2. Minimum 13.0 R value.
   3. Double wall with thermal break construction with no metal path from inside to outside.
   4. Foam in place insulation.

2.3 SUPPLY FAN

A. Fan:
   1. Horizontal unit discharge.
   2. Double width, double inlet forward-curved centrifugal type.
   3. Statically and dynamically balanced.
   4. Wheel and housing to be of galvanized steel.
   5. Shaft:
      a. Solid steel.
      b. Mounted in 200,000-hour rated, relubricatable ball bearing assemblies.

B. Motor: Comply with the requirements of Division 23 Section “Common Motor Requirements for HVAC Equipment.” Provide with variable speed drive factory-wired and mounted.

C. Vibration Isolation:
   1. Completely isolate entire fan assembly from the unit bulkhead with spring isolators.
   2. Provide spring isolation of compressors.
   3. Entire unit shall mounted on a neoprene gasket between the unit and the curb.
   4. Comply with the requirements of Division 23 Section “Sound and Vibration Control for HVAC.”
   5. System shall meet building code seismic requirements.

2.4 STEAM HEATING SECTION

A. The assemble shall include steam coil, two-way modulating valve and actuator, and filter section, and shall be shipped loose to be field installed.

B. Coil shall be constructed of seamless copper tubing, 1” O.D. arranged in a parallel pattern. Copper tubes shall be mechanically expanded with aluminum fins along the entire coil width. 42 fins per foot maximum.

C. Coil casing shall be 16-gauge galvanized steel.

D. Performance shall be rated in accordance with AHRI Standard 410 with a maximum working pressure of 200 psig.
E. Supply and return header connections shall be female tapered NPT and accessed from the left side of the unit.

F. Control: Factory provided controls must limit the leaving air temperature from the heating coil to no more than 105 degrees F at all operating conditions.

2.5 REFRIGERATION SYSTEM

A. Compressor:
1. Compressors shall be heavy-duty, hermetic scroll type with oil pump, suction and discharge line service valves, crankcase heater and inherent solid-state thermal overload protection.
2. Each compressor shall have its own completely independent refrigeration circuit including sight-glass, filter-drier, manual shutoff valve and spring-tube high pressure relief valve.
3. Compressors shall be isolated on spring isolators.

B. Water Cooled Condenser:
1. The condenser shall be shell and tube design with removable heads to allow for tubes to be mechanically cleaned.
2. Condenser coils shall be multi-row type fabricated with 3/4-inch O.D. seamless copper.
3. Condenser waterside working pressure shall be rated for 400 psig.
4. Condenser water piping, including cleanouts, shall be factory installed and provides a single field connection for the water inlet and outlet.

C. Condenser Water Piping:
1. Unit shall have factory installed piping option, left-hand connections.
2. Manifold piping and control valve shall be factory installed.
3. Condensing pressure control valve and two-way modulating valve shall be factory installed to maintain a specific range of water temperature rise through the condenser when entering water temperature is less than 58 degrees F.
4. Minimum flow rate to maintain minimum condenser flow rates shall be user adjustable.
5. A water flow switch shall be factory installed and shall shut down the unit when a loss of flow occurs.

D. Evaporator Coil:
1. Evaporator coils shall be multi-row type fabricated from 1/2-inch O.D. seamless copper tubing mechanically bonded to rippled and corrugated aluminum fins, with a maximum of 12 fins per inch.
2. Coils shall be factory leak tested at 200 psig under water.
3. The evaporator coil circuiting shall be fed with an adjustable thermal expansion valve (1 per refrigerant circuit) with an external equalizer.
4. The evaporator coil shall be circuit for a row split.

E. Control:
1. Each compressor circuit shall include a liquid line solenoid valve, oil pressure switch, high pressure switch, low pressure switch, and compressor control circuit switch.
2. Each refrigeration circuit shall have at least 1 condenser fan controlled from an ambient thermostat for positive head pressure control.
3. An adjustable 5-minute timer shall be provided for each compressor circuit to prevent short cycling.

F. Condensate Drain:
1. A stainless steel primary drain pan shall be provided with the cooling coil and extend beyond the leaving side of the coil and underneath the cooling coil connections.
2. The drain pan shall be connected to a threaded drain connection extended through the unit base.
3. Manufacturer shall demonstrate that the unit is designed and constructed such that all overflow from the drain pan cannot enter the building when correctly installed on the curb and the overflow will instead spill onto the roof. Alternatively, a pre-wired water monitoring device in compliance with Paragraph 307.2.3.1 of the latest edition of the International Mechanical Code may be used.

2.6 FILTER SECTION

A. Housing: Filter section shall be provided as integral section of the Steam Heating with integral access doors.
B. Filters:
1. As manufactured by Farr Company; or equal.
2. Filter:
   a. 2-inch depth, MERV 8.
   b. 25% minimum efficiency per ASHRAE Test Standard 52.
3. Provide clogged filter switch with 24-volt dry contact.

2.7 ECONOMIZER SECTION

A. Configuration: Outside and return air section shall form a plenum with outdoor air introduced through horizontal intake hood complete with rain lip and bird screen.

B. Drainage: Floor of outdoor air section shall be sloped for water drainage.

C. Outdoor and Return Air Dampers:
1. Dampers shall be constructed of 16 gage galvanized steel and mounted on circular shafts for easy rotation.
2. Damper blades shall be operated from multiple sets of linkages mounted on the leaving face of the dampers.
3. The outside and return air dampers shall be sized to handle 100% of the supply air volume and arranged to converge the 2 air streams in a circular mixing pattern.
4. Damper blades shall be coated with alkyd enamel paint.

2.8 ELECTRICAL

A. Variable Frequency Drive: The unit shall be supplied with a factory installed and tested variable frequency drive, shipped loose and field mounted. The VFD shall be matched for the fan motor according to the FLA rating of the motor.

B. Wiring:
1. Each unit shall be wired and tested at the factory before shipment.
2. Wiring shall comply with NEC requirements and shall conform with all applicable UL standards.
3. All wiring shall be number coded in accordance with the electrical wiring diagrams.

C. Components:
1. All electrical components shall be labeled according to the electrical diagram and be UL recognized where applicable.
2. Each unit shall have the following:
   a. A 115 volt control circuit transformer.
   b. System service switch and control circuit fuse.
   c. 115 volt GFCI receptacle that will remain energized when unit disconnect is open.

D. Overload Protection:
1. All motor branch circuits shall be individually fused.
2. Contactors and inherent thermal overload protection shall be furnished for each compressor and condenser fan motor.
3. The supply air fan motors shall have contactors and external overload protection.

E. Control Panel:
1. Main control panel shall be of weatherproof construction with a dead-front cover over the main power circuit controls.
2. Furnish with integral latch/disconnect switch to cut power to unit before opening control panel door.
3. A separate control panel shall house all controls for the refrigeration section.

F. Connections:
1. A terminal block shall be provided for the power connection and a terminal board shall be provided for the low voltage control wiring.
2. Knockouts shall be provided in the bottom of the main control panel for field wiring entrance.
2.9 CONTROLS

A. Provide unit-mounted microprocessor-based control package to provide sequence of operation as described in Division 23 Section “Instrumentation and Control for HVAC.”
   1. Unit mounted control shall be capable of stand alone.
   2. Provide communication interface with building management system.

B. Field-Mounted Components:
   1. Provide remote sensor to be mounted in supply and return duct at remote location.
   2. Duct Smoke Detectors:
      a. Provide photoelectric type detectors:
          1) UL listed, Standard 268A.
          2) 24 volt.
          3) Visible LED alarm.
          4) Auxiliary contacts.
          5) Multi-length air sampling type.
          6) Uniform sensitivity over full range of air velocities characteristic of specific installation.
      b. Capable of detecting combustion gases, fire and smoke in air conditioning and ventilation systems in compliance with the NFPA Standards 72E and 90A.
      c. Provide detectors compatible with the building fire alarm system to allow interfacing. Detectors are to be powered from the fire alarm system.
      d. Manufacturer: Simplex 2098 series, or as approved.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that roof is ready to receive work, all auxiliary support steel is in place, and opening dimensions are as recommended by unit Manufacturer.

B. Verify that proper power supply is available.

3.2 COMMISSIONING

A. In addition to the requirements above, the Manufacturer’s representative shall be on Site for a minimum of 1 day to demonstrate compliance with operational intent and Start-up Checklists.

3.3 INSTALLATION

A. Install in accordance with Manufacturer’s instructions.

B. Contractor shall do all necessary interconnecting of wiring and assembly of sections if the units are shipped in sections.

C. Provide installation accessories as detailed on all units.

D. Contractor to install plastic piping for condensate drain.

E. Air Cleaning: Refer to Division 23 Section “General HVAC Provisions” for construction period filter change requirements.

F. Unit Controls: Refer to Division 23 Sections “Instrumentation and Control for HVAC”.

END OF SECTION 23 74 43
SECTION 26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL

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. Electrical equipment coordination and installation.
   2. Sleeves for raceways and cables.
   3. Sleeve seals.
   5. Duct seal.
   6. Common electrical installation requirements.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with
   1. NECA 1 - Standards Practices for Good Workmanship in Electrical Construction.
   2. NEC – National Electrical Code (NFPA 70)

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration, damage, contamination with foreign matter, and damage by weather or elements, and according to Manufacturer's directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, weathertight wrapping.

D. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

1.6 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right-of-way for piping and conduit installed at required slope.
   4. So connecting raceways, cables, wireways, and cable trays will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Sections.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Sleeves for Rectangular Openings: Galvanized sheet steel.
   1. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
      b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.3 DUCT SEAL

A. Description: UL listed, pliable, non-hardening, non-corrosive, weather-proof putty material, designed as a moisture barrier for weather-sealing service entries, electrical cables, and conduit ducts.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Amcor Corp. - Hydra-Seal
      b. Ilsco Corp. – DS Duct Seal
      c. JM Clipper - Duxseal
      d. OZ/Gedney Co. – DUX
      e. RectorSeal - Duct Seal Compound
      f. Thomas & Betts Corp. - DX.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1 and NEC.

B. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in a manner as to facilitate future disconnecting with minimum interference with other items in the vicinity.

D. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless otherwise indicated on the Drawings.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

3.3 Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Sections.

3.4 SLEEVE-SEAL INSTALLATION

A. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.5 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Sections.

END OF SECTION 26 05 00
SECTION 26 05 20 – CONDUCTORS AND CABLES – 600V AND BELOW

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 furnishing and installation of all electrical conductors, cables, splices, and connectors.

B. Major Systems Include:
   1. 600V and below feeders and electrical distribution.
   2. Branch circuit wiring.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the standards of the following organizations as applicable to materials, construction and testing of wire cables:
   1. NEMA - National Electrical Manufacturer Association Standards.
   2. IEEE Standards.
   3. Insulated Cable Engineers Association - Standards.
   4. ASTM Standards.
   5. NEC - National Electric Code

1.4 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed submittals.

B. Manufacturers: Firms regularly engaged in the manufacture of electrical conductor and cable products of the types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer’s directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, watertight wrapping.

D. Reject damaged, deteriorated, or contaminated materials and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.
PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Except as otherwise indicated, provide conductors, cables, and connectors of Manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by the Manufacturer and as required for the installation.

B. Power Wire:
   1. All conductors and cables shall be new with a minimum wire size of No. 12 AWG. Manufacturer's name, type, and size shall be permanently marked on the outer covering at regular intervals and delivered in complete coils or reels.
   2. Provide factory fabricated conductors of size, rating, material, and type as indicated for each service. Where not indicated, provide proper selection as determined by installer to comply with installation requirements and with NEC standards, from only following types and conductors:
      a. Type THHN/THWN, 600 Volt, 75/90 Degrees C Rated with Nylon Jacket: Stranded copper for all sizes.
      b. Bare Conductors: Stranded copper for all sizes.

C. Control Cable: No. 14 AWG minimum, type THHN/THWN, plenum rated.

D. Power Wiring Cable Accessories: For Connectors:
   1. Wing nuts by Ideal.
   2. Stan-Kon by Thomas & Betts.
   4. Compression Type 53200 by Thomas & Betts.
   5. Hydent by Burndy.
   6. Insulated multi-cable mechanical connector blocks by Polaris, or Ilsco.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Install electrical conductors, cables, and connectors as indicated on the Drawings, in accordance with the Manufacturer's written instructions, the applicable requirements of NEC and the National Electrical Contractors Association's "Standard of Installation" and in accordance with recognized industry practices to ensure that products serve the intended functions.
   2. Conductors and cables shall be sized in accordance with the Drawings or, in the absence thereof, in accordance with NEC requirements. Except and indicated herein, conductor sizes greater than No. 12 AWG are indicated on the Drawings.
   3. Provide dedicated ungrounded conductor (neutral) for each 20A, 120V circuit.

B. Voltage Drop Compensation:
   1. Provide No. 10 AWG conductors in lieu of No. 12 AWG conductors to compensate for voltage drop as follows:
      a. For each 277V, 20 ampere branch circuit that exceeds 200 feet in length between the branch circuit panelboard and the last outlet.
      b. For each 120V, 20 ampere branch circuit that exceeds 100 feet in length between the branch circuit panelboard and the last outlet.
   2. When conductor size is increased to compensate for voltage drop, provide equipment grounding conductor increased in size in accordance with NEC.

C. Installation Procedures:
   1. Install interior conductors after building is enclosed and water tight.
   2. Each conduit shall be free of moisture and debris before conductors are installed.
   3. Remove moisture from conduits by swabbing.
   4. Install conductors so insulation is not damaged. Replace all conductors that are damaged.
5. Install conductors and cables only in code conforming raceway.
6. Pull conductors together where more than 1 conductor is being installed in a raceway.
7. Use heat shrink tubing for all instrument signal cable terminations.
8. Use manufacturer-approved pulling compound or lubricant, where necessary. Compound shall not deteriorate conductor and insulation. Compounds shall be UL listed.
9. Use a pulling means, including fish tape, cable or rope, and basket-weave wire/cable grips, that will not damage the raceway or the wire.
10. Keep conductor splices to a minimum.
11. Install splices and taps which have equivalent or better mechanical strength and insulation as the conductor.
12. Use splice and tap connectors which are compatible with the conductor material.
13. Make all joints, splices, and connections only at accessible junction or outlet boxes, never inside conduit or fitting. Make splices in No. 10 AWG and smaller wire with insulated spiral mechanical connectors.
14. Make splices in No. 8 AWG and larger copper wire with compression type mechanical connectors.
15. All splices located in handholes and wet locations shall be rated for wet locations.
16. Insulate all joints at splices with “Scotch” brand electrical pressure sensitive tape to 150% of conductor insulation value.
17. Make conductor length for parallel feeds identical.
18. Where exposed cables are installed, cables shall be installed parallel and perpendicular to exposed structural members and building lines.
19. Do not lace, strap or tie feeder or branch circuit conductors together in panels, switchboards, variable speed drives, motor control centers, automatic transfer switches, boxes, and wireways.
20. Feeders and service entrance conductors entering electrical equipment shall be adequately secured with cable cleats.
21. Use color coded conductors as follows:
   a. Phases: Black-red-blue (under 150V to ground).
   b. Phases: Brown-orange-yellow (over 150V to ground).
   c. Neutral: White identified (feeders); White (branch circuits).
   d. Ground: Green identified (feeders); Green (branch circuits).
22. Support conductors in vertical raceways in accordance Division 26 Section “Hangers and Supports for Electrical Systems.”
23. Outlets:
   a. Leave at least 6 inches of free conductor at all outlets except where conductors are intended to loop without joints through outlets for fixtures or wiring device hook-ups.
   b. Free ends and loops at boxes and enclosures shall be pushed back into boxes and protected by blank cover plates or other means until interior painting and decorating work is completed.
24. Lights and outlets shall be grouped on circuits as indicated on the Drawings. Different types of circuits such as feeders, branch circuits, control circuits, and signal circuits, shall not be mixed in common conduit runs, but shall be run separately, although more than 1 circuit of the same system may be run in common conduit runs.
25. Fire Alarm Circuits: Power limited, fire-protective signaling circuit cable in raceway, cable tray or conduit.

3.2 FIELD QUALITY CONTROL

A. General:
   1. Prior to energization, check conductors and cables for continuity of circuitry and for short circuits. Correct malfunctions when detected.
   2. Subsequent to conductor and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements.

END OF SECTION 26 05 20
SECTION 26 05 27 – GROUNDING AND BONDING

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 furnishing and installation of a complete and continuous grounding system.

1.3 DESIGN AND PERFORMANCE REQUIREMENTS

A. All equipment, raceway systems, interior wiring systems with neutrals, receptacles, and power outlets, motors and motorized equipment shall be grounded.

1.4 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design.

B. Grounding system shall be in accordance with the current National Electrical Code.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: A portion of the required materials for grounding systems are specified in the Division 26 – Electrical Sections.

B. Connectors:
   1. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions as manufactured by Thomas and Betts; or equal.
   2. Irreversible Compression Connectors: Compression connections shall be irreversible, cast copper, high conductivity as manufactured by Thomas and Betts; or equal.

PART 3 - EXECUTION

3.1 POWER SYSTEM GROUNDING

A. Make cable to rod and cable to cable connections by using exothermic-welding process, or irreversible compression type connectors made for direct burial.

B. Irreversible compression connectors shall be factory filled with an oxide inhibitor and installed with the connector manufacturer’s die such that the die index matches the listed index on the connector. Connectors shall be fully crimped with a 14 ton or larger hydraulic tool such that the index number is embossed on the connector. Irreversible compression connectors may be used in below grade, above grade, building steel, electrode connections and concrete encased applications. Connectors shall comply with IEEE 837, UL467 and CSA22.2.

3.2 DISTRIBUTION SYSTEM GROUNDING

A. Circuit Grounding: Install grounding bushings, grounding studs, and grounding jumpers at distribution centers, pull boxes, and panelboards.
B. Bonding Jumpers:
   1. Provide green insulation, size correlated with overcurrent device protecting the wire, attached to
      grounding bushings on conduits, to lugs on boxes, and other enclosures.
   2. Bond to neutral only at service neutral bar.

C. FMC and LTFMC: Install separate grounding conductor in FMC and LTFMC. Connect each end to a grounding
   bushing.

D. Receptacles and Power Outlets: Ground receptacles and power outlets to the conduit system with a Type
   THHN green grounding conductor sized in accordance with NEC Article 250 and connected between the
   device grounding screw and outlet box.

E. Metallic Conduit: When grounding conductors are enclosed in metallic conduit, the conduit shall be bonded
to the grounding conductors at both ends.

F. Ground motor bases and frames by pulling a separate conductor in with the motor feeder.

G. Expansion Joints: Install a bonding jumper around expansion fittings in metallic conduit to maintain ground
   continuity.

H. Separately Derived Systems: Grounding of separately derived systems, i.e., secondary transformers, shall
   be in accordance with NEC, Article 250. Use suitable ground lugs and clamps approved for this purpose.

END OF SECTION 26 05 27
SECTION 26 05 29 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the furnishing and installation of the following:
   1. Hangers and supports for electrical equipment and systems.

1.3 DEFINITIONS

A. Electrical Supports: Angles, channels, brackets, and mounting accessories for supporting all conduit, luminaires, switches, and other electrical equipment which are hung or mounted above floor.

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

A. This Section defines general criteria for the selection and installation of supporting devices, but does not cover all types specifically required for the Project.

B. Choose or design supporting devices in accordance with these general criteria.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed submittals.

B. Regulatory Agencies Requirements:
   1. Provide supporting devices listed by Underwriters’ Laboratory for their application as installed.
   2. Comply with National Electrical Code (NFPA 70) as applicable to construction, installation, and requirements for supporting devices.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer’s directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, watertight wrapping.

D. Reject damaged, deteriorated, or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.
PART 2 - PRODUCTS

2.1 MATERIALS

A. Conduit Supports:
   1. Single Runs: Galvanized conduit straps or ring bolt type hangers with spring clips. Do not use plumber’s perforated straps.
   2. Use fiberglass supports in the mechanical room areas. Hardware used in the mechanical rooms shall be stainless steel.
   3. Multiple Runs: Conduit rack with 25% spare capacity.
   4. Vertical Runs: Channel support with conduit fittings.
   5. Manufacturers:
      a. Cooper B-Line; a division of Cooper Industries
      b. ERICO International Corporation.
      c. Allied Support Systems; Power-Strut Unit.
      d. GS Metals Corp.
      e. Michigan Hanger Co., Inc.; O-Strut Div.
      f. National Pipe Hanger Corp.
      g. Thomas & Betts Corporation.
      h. Unistrut; Tyco International, Ltd.
      i. Wesanco, Inc.
      j. Or equal.

B. Mounting, Anchoring, and Attachment Components
   1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   2. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   3. Manufacturers:
      a. Hilti, Inc.
      b. ITW Construction Products.
      c. MKT Fastening, LLC.
      d. Or equal.

C. Supports for Conductors in Vertical Conduit:
   1. Install in compliance with NEC article 300.19.
   2. Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Layout to maintain headroom, neat mechanical appearance, and to support equipment loads.
   2. Secure Engineer's approval before welding or bolting to steel framing or anchoring to concrete structure.
   3. Where equipment is to be suspended from cast-in-place concrete construction, set approved concrete inserts in formwork to receive hanger rods. Where equipment is to be suspended from metal deck and beam or joist construction, support equipment from beams or joists only.
SECTION 26 05 34 – RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the furnishing and installation of conduits and fittings for electrical wiring.

1.3 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design.

B. Regulatory Agencies Requirements:
   1. ACI – American Concrete Institute – Standards pertaining to conduits embedded in concrete (Section 6.3 in ACI 318 – Building Code Requirements for Structural Concrete and Section 6.3 in ACI 350R – Environmental Engineering Concrete Structures.)
   2. NEMA – National Electrical Manufacturer’s Association – Standards pertaining to raceways.
   3. NEC – National Electric Code – As applicable to construction and installation of conduit system.
   4. Provide conduit which is listed and labeled by Underwriters’ Laboratories.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage (e.g., bending, end damage, finish scoring), contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer’s directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, watertight wrapping. Provide color coded end cap thread protectors on exposed threads of threaded metal conduit.

D. Reject damaged, deteriorated, or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Rigid Steel Conduit (RSC): Galvanized steel, heavy wall conduit with threaded fittings, 1/2-inch trade size minimum, insulated bushings.

B. Electrical Metallic Tubing (EMT):
   1. Thin wall, hot galvanized, steel tubing, 3/4-inch trade size minimum with insulated throat steel connector.
   2. Fittings: Steel Compression (die cast fittings are expressly prohibited).
C. Surface Metal Raceway (SMR):
   1. Two-piece steel raceway including a base and snap-on cover. Manufacturer: Wiremold, or equal. Provide type as indicated on the drawings.
   2. UL listed.
   3. Fittings, couplings, junction boxes, and accessories as required. Color to match raceway.
   4. Provide all necessary components for a complete, functioning, SMR system, including fittings, devices, straps, etc for line voltage and low voltage components.

D. Flexible Metal Conduit (FMC): 1/2-inch trade size minimum with galvanized steel flexible conduit insulated throat steel connectors.

E. Liquid Tight Flexible Metal Conduit (LTFMC): 1/2-inch trade size minimum with galvanized steel flexible conduit with flexible, moisture-proof PVC jacket and liquid tight connectors.
   1. In the mechanical room areas, LTFMC fittings shall be PVC coated.

F. PVC Coated RSC:
   1. Galvanized RSC with a minimum of 40 mil PVC exterior coating and 2 mil urethane internal coating.
   2. Manufacturers:
      a. Robroy Industries: Plasti-Bond RED.
      c. OCAL, Inc.: OCAL-BLUE.
   3. All fittings, conduit bodies, outlet boxes, and accessories shall be products of the same Manufacturer and shall be coated with a minimum of 40 mil PVC exterior coating and 2 mil urethane internal coating.
   4. Finished conduit shall fully conform to the current NEMA Standard RN-1 and shall have a label affixed indicating compliance with UL Standard No. 6.

G. Joint Compound for RSC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

H. Conduit Hubs for RSC:
   1. Suitable for environment served.
   2. Grounding screw.
   3. O-ring gasket.
   4. Material: stainless steel Type 316.
   5. Manufacturer:
      a. Cooper Myers Hubs.
      b. Thomas & Betts.
      c. Killark.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Unless otherwise specified or indicated on the Drawings, conceal conduit to the extent possible.
   1. In finished areas where conduit cannot physically be concealed due to existing conditions, provide surface metal raceway. Finished areas are generally, but not always: above grade, heated spaces with finished walls (e.g., painted, drywall, etc.), finished floors (e.g., painted concrete, carpet, tile, etc.), and finished ceilings (e.g., drywall, suspended ceiling grids, wood, etc.).
   2. Conduit shall not be concealed within tank walls, slabs, or ceilings.
   3. Do not conceal conduit in Corrosive Locations.

B. Exposed conduit permitted in:
   1. Mechanical and Electrical equipment rooms.
   2. Rooms without finished ceilings (overhead only).
   3. Unfinished rooms.
C. Install conduit products in accordance with:
   1. The Manufacturer's written instructions.
   2. Applicable requirements of NEC and National Electrical Contractors Association's "Standard of Installation."
   3. Recognized industry practices to ensure that products serve intended function.

D. Conduit Joints: Cut square, reamed smooth and drawn up tight.

E. Thru threaded conduit joints, exposed to wet, damp, corrosive or outdoor conditions: Apply listed compound to threads of raceway and fittings before making up joint. Follow compound manufacturer’s written instructions.

F. Bends:
   1. Number per run for conduit that support feeder and branch circuits: Do not exceed the equivalent of 4 quarter bends (360 degrees) between pull points.
   2. Number per run for conduit that supports data/communications cabling: Do not exceed the equivalent of 2 quarter bends (180 degrees) between pull points.
   3. Make bends and offsets so as not to reduce the inner diameter of the conduit.
   4. To the extent possible, avoid using large junction boxes as 90 degree junctions.

G. Routing:
   1. Concealed Conduits: Run in a direct line with long sweep bends and offsets.
   2. Exposed Conduits: Run parallel to, and at right angles to, building lines.
   3. Run continuous from outlet to outlet and from outlets to cabinets, pull or junction boxes.
   4. Secure to all boxes and cabinets with locknuts and bushings in such a manner that each system is electrically continuous throughout.

H. Cap conduit ends to prevent entrance of foreign materials during construction.

I. Provide insulated bushings on all threaded conduit run terminations and where entering the bottom of open-bottom switchboards, transformers, and similar equipment.

J. Where entering the bottom of open-bottom equipment (i.e., switchboards, panelboards, transformers, and similar equipment) conduit shall not be installed flush with the floor/equipment pad and shall not rise more than 3 inches above the bottom of the enclosure.

K. Conduit entering control panels shall not obstruct internal components and shall allow for neat and workmanlike wire management.

L. Completely install all conduit systems before installing conductors.

M. Support:
   1. Adequately support conduit from structural elements of the building.
   2. Do not drill or tap structural building steel without approval from Engineer.
   3. Do not rest conduit on, nor support it from, ceiling suspension systems, ceiling tiles or mechanical equipment including, but not necessarily limited to ductwork and fans.
   4. Conduit shall be supported in accordance with the NEC and Division 26 Section "Hangers and Supports for Electrical Systems."

N. Provide conduit expansion couplings where conduits cross building or structure expansion joints.

O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200 pound (90 kg) tensile strength. Label and leave at least 12 inches of slack at each end of pull wire.

P. FMC and LTFMC Installation:
   1. Provide separate grounding conductor in accordance with Division 26 Section “Grounding and Bonding.”
   2. Connection to light fixtures shall not exceed 6 feet in length within an accessible ceiling and 3 feet in length where exposed. Connection to solenoids, pressure switches, motors, fans, HVAC equipment, and similar equipment shall not exceed 3 feet in length.
Q. PVC Coated RSC Installation:
1. Install in accordance with Manufacturer’s published installation guide, National Electrical Code, local codes and standard trade practices.
2. Use Manufacturer’s recommended pipe wrenches, clamping devices, benders, and threading tools.
3. Provide PVC coated fittings at each termination point.
4. Field threads shall be degreased and coated with Manufacturer’s recommended compounds.
5. Provide separate grounding conductor in accordance with Division 26 Section “Grounding and Bonding.”
6. Take care not to damage PVC coating during assembly, cutting, bending, clamping, and threading.
7. Use Manufacturer's approved touch-up compound to repair nicks and cuts to the outer PVC jacket, and for use as a sealant. Where large abrasions are made in the outer PVC jacket the conduit shall be replaced.

R. Firestopping: Firestop all conduit penetrations of fire rated barriers by using approved material to ensure integrity of the rating

3.2 CONDUIT SCHEDULE

A. Feeders, Branch Circuits and System Conduits:
1. Above Slab or Grade:
   a. Exposed Conduit Below 10'-0" AFF: RSC or IMC where subject to physical damage. EMT where not subject to physical damage.
   b. Exposed Conduit Above 10'-0" AFF: EMT.
   c. Concealed In Walls: EMT or FMC.
   d. Concealed Above Ceiling: EMT.
   e. Corrosive Locations (Mechanical Rooms): PVC coated RSC.

B. Data/communications conduits in dry locations not subject to physical damage and not installed underground nor in or below concrete: EMT.
1. Data/communication conduits shall be bonded.
2. Data/communication sleeves, provide plastic bushings.
3. Data/communication conduits shall be 3/4-inch minimum.

C. Connection To Equipment:
1. Lighting Fixtures and Control Devices (including, but not necessarily limited to solenoids, pressure switches, and field instruments):
   a. Dry Locations: FMC.
   b. Wet or Damp Locations: LTFMC.
   c. Corrosive Locations (Mechanical Rooms): LTFMC with PVC coated fittings.
2. Vibrating Equipment (including, but not necessarily limited to motors and transformers):
   a. Motors:
      1) Dry Locations: FMC.
      2) Wet or Damp Locations: LTFMC.
      3) Corrosive Locations (Mechanical Rooms): LTFMC with PVC coated fittings.
   b. Transformers at Dry Locations: FMC.

D. Provide separate raceway systems for:
1. Normal power wiring.
2. Emergency power wiring.
3. Data/communication wiring.
4. Fire alarm system wiring.
5. A.C. signal and control wiring.
6. Low voltage signal and control wiring.

END OF SECTION 26 05 34
SECTION 26 05 35 – BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the furnishing and installation of all electrical boxes and the major items listed below:
   1. Outlet boxes.
   2. Junction boxes.
   3. Pull boxes.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. NEMA - National Electrical Manufacturer's Association: Standards as applicable to nonmetallic fittings for underground installation.
   2. NECA - National Electrical Contractor's Association's: Applicable portions of "Standard of Installation".

1.4 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed submittals.

B. Regulatory Agencies Requirements:
   1. Provide boxes which are listed and labeled by Underwriters' Laboratories.
   2. NEC - National Electrical Code (NFPA 70) - As applicable to construction and installation of electrical boxes.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer’s directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, watertight wrapping.

D. Reject damaged, deteriorated, or contaminated materials and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Interior Outlet Boxes:
   1. Galvanized steel outlet boxes of the type, shape, and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices.
2. In areas requiring exposed RNMC, provide nonmetallic outlet boxes of type, shape and size to suit each location. Each box is to have conduit hubs with removable plugs and a non-metallic cover. Each box shall be compatible with RNMC.

B. Interior Outlet Box Accessories:
1. As required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps, and metal straps for supporting outlet boxes. Accessories shall be compatible with outlet boxes being used and meet the requirements of individual wiring situations.
2. Choice of accessories is installer's option.

C. Weatherproof Outlet Boxes: Corrosion-resistant cast metal, weatherproof outlet boxes, of the type, shape, and size, including depth of box, suitable for each application, with threaded conduit ends.

D. For Ceilings: 4-inch octagonal boxes for receiving 3 or less 1/2-inch conduits.

E. For Flush Mounting In Walls:
1. 4-inch square boxes with matching plaster cover for single or 2 gang outlets.
2. For larger boxes use solid type or special units.
3. In masonry, use deep boxes.

F. Surface Mounted: 4-inch square.

G. Junction and Pull Boxes: Sheet steel junction and pull boxes, with screw-on covers; of the type and shape and size to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws, and washers. Dry interior location boxes shall have baked enamel finish. Damp location and exterior boxes shall have galvanized finish.

H. Flush Mounted Pull Boxes: Provide overlapping covers with flush-head cover retaining screws, prime coated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Install electrical boxes as indicated, in compliance with NEC requirements and in accordance with the Manufacturer's written instructions and recognized industry practices to ensure that the boxes and fittings serve the intended purposes.
2. Provide weatherproof outlet boxes for interior locations exposed to weather or moisture.
3. Provide knockout closures to cap unused knockout holes where blanks have been removed.
4. Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.
5. Secure boxes rigidly to the substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.
6. Mount outlet boxes flush in areas other than mechanical rooms, electrical rooms, and above removable ceilings.
7. Adjust position of outlets in finished masonry walls to suit masonry course lines.
8. Do not install boxes back-to-back in same wall. Coordinate cutting of masonry walls to achieve neat openings for boxes.
9. Do not use sectional or handy boxes unless specifically requested.
10. For boxes mounted in exterior walls install insulation behind outlet boxes to prevent condensation in boxes.
11. For outlets mounted above counters, benches, and splashbacks, coordinate location and mounting heights with built-in units. Adjust outlet mounting height to agree with required location for equipment served.
12. Outlet boxes in finished areas shall be located as indicated on the Drawings and so set that the face plates will be flush with the finish on which it is mounted. Where 2 or more devices of any kind are set side by side, set them in gang boxes unless otherwise noted on the Drawings.
13. Locate pull boxes and junction boxes above removable ceilings or in electrical rooms, utility rooms, or storage areas such that boxes will be accessible after completion of building.
14. All boxes shall have covers installed at completion of construction.

END OF SECTION 26 05 35
SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the furnishing and installation of proper identification for electrical system components.

B. Items requiring identification or labeling include:
   1. Cables and conductors.
   2. Conduit systems.
   3. Controls:
      a. Motor starters.
      b. Variable frequency drives.
   4. Distribution Equipment:
      a. Disconnect switches.
      b. Enclosed circuit breakers.
      c. Switchboards.
      d. Transformers.
      e. Panelboards.
   5. Fire alarm system equipment.

1.3 SUBMITTALS

A. Nameplate schedule identifying each device to be labeled and project specific label text.

PART 2 - PRODUCTS

2.1 ELECTRICAL LABELS

A. Provide engraved laminated plastic nameplate to identify each piece of electrical equipment:
   1. Nameplate shall have 3/8-inch minimum black letters on a white background.
   2. Punched or drilled for mechanical fasteners.

B. Provide printed labels by Brady or T&b to identify conductors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Attach nameplates directly to each piece of electrical equipment. In finished areas of building, install nameplates behind enclosure door where possible.
   2. Where several conductors pass through a pull box, junction box, or enclosure, provide wire labels. Group wires before labeling.

B. Cables and Conductors: In accordance with Division 26 Section “Conductors and Cables – 600V and Below.”

C. Conduit Systems:
   1. Junction boxes used for fire alarm system wiring shall be red.
   2. Provide label inside each junction and pull box identifying circuit numbers for all conductors contained inside the box. Labeling shall be printed neatly with permanent, waterproof, black ink marker.
D. Controls: For each of the following control devices, provide label attached to enclosure cover. Label shall identify:
   1. Motor Starters: Name of equipment served and load (example, “EF-5, 5 HP”).
   2. Variable Frequency Drives: Name of equipment served and load (example, “P-1, 25 HP”).

E. Distribution Equipment: For each of the following pieces of distribution equipment, provide label attached to enclosure cover. Label shall identify:
   1. Disconnect Switches: Name of equipment served, number of poles, ampere rating/fuse size (where applicable), and load (example, “RTU-1, 3P30/25, 8 TON”).
   2. Enclosed Circuit Breakers: Name of device as indicated on one line diagram, number of poles, and circuit breaker size (example, “MCB, 3P200”).
   3. Switchboards:
      a. Name of device as indicated on one line diagram and voltage-phase (example, “MSWBD, 480Y/277V-3Ø”).
      b. Provide label near each feeder/branch breaker identifying name of equipment served, number of poles, and circuit breaker size (example, “TRANSFORMER T-LPA, 3P80”).
   4. Transformers: Name of device as indicated on one line diagram, KVA rating, primary voltage: secondary voltage, source transformer is fed from, and load transformer feeds (example, “T-LPA, 45 KVA, 480:208Y/120V, FED FROM MSWBD, FEEDS PANEL LPA”).
   5. Panelboards:
      a. Name of device as indicated on one line diagram, voltage-phase, and area served (example, “LPA, 208Y/120V-3Ø, First Floor Lighting”).
      b. Equip interior of enclosure door with a circuit directory frame, typewritten card, and clear plastic cover. Directory shall identify load description for each circuit, including spares. Hand lettering is not acceptable.

F. Fire Alarm System Equipment: Provide label attached to enclosure cover. Label shall identify name of device as indicated on fire alarm system riser diagram or electrical drawings (example, “FIRE ALARM CONTROL PANEL”).

END OF SECTION 26 05 53
SECTION 26 09 23 – LIGHTING CONTROL DEVICES

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 furnishing and installation of all lighting control devices listed below:
   1. Occupancy sensors (wall and ceiling mounted) and related power packs.
   2. Photo sensors (daylight harvesting).
   3. Time clocks.
   4. Ballast load transfer control relay devices (UL924).

1.3 SUBMITTALS

A. Shop Drawings: Provide the following information for each type of lighting control device.
   1. Name of Manufacturer.
   2. Model number.
   3. Details of construction and installation.
   4. Assembly drawings, including elevations, plans, sections, and dimensions.
   5. Project Specific Point-To-Point Wiring Diagrams:
      a. Diagrams shall clearly identify all field wiring requirements.
      b. Connection points shall be identified by terminal number.
   6. Project specific floor plans, including all occupancy sensor types, photo sensor type locations, as recommended by Manufacturer.
   7. Color and finish.
   8. Options and accessories.

B. Installation Instructions: For lighting control devices.

C. Manufacturer’s Certification: For lighting control devices:
   1. Sworn statement that the equipment furnished complies with this Specification.
   2. Written approval of installation.

D. Installation and Maintenance Manuals: For lighting control devices.
   1. Equipment function, normal operating characteristics, and limiting conditions.
   2. Assembly, installation, alignment, adjustment, and checking instructions.
   3. Operating instructions for start-up, routine and normal operating, regulation and control, shutdown, and emergency conditions.
   5. Guide to “troubleshooting.”
   6. Parts list and predicted life of parts subject to wear.
   7. Project specific outline and cross-sections, assembly drawings, engineering data, and wiring diagrams.
      Wiring diagrams shall reflect final, as-installed conditions and include wire numbers.
   8. Test data and performance curves.

1.4 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed submittals.
B. Manufacturer:
   1. At least 5 years experience with approved systems.
   2. Provide Owner training on system operation.

C. Components: All equipment shall be UL listed.

1.5 WARRANTY

A. In accordance with the warranty provisions defined in the General Conditions and Supplementary Conditions: Includes all lighting control systems.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer's directions.

C. Store materials indoors and protect from weather.

D. Reject damaged, deteriorated, or contaminated materials and immediately remove from the Site. Replace rejected material with new material at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Occupancy Sensors:
   1. Lutron.
   2. Wattstopper.
   3. Hubbell.
   4. Sensor Switch.
   5. All occupancy sensors shall be produced by the same Manufacturer.

B. Ballast Load Transfer Control Relay Devices (UL924):
   1. Nine 24, Inc.
   2. The Bodine Company.
   3. LVS, Inc.
   4. Lithonia.

C. Photo Sensors (Daylight Harvesting):
   1. Leviton.
   2. Lutron.
   3. Wattstopper.
   4. Hubbell.
   5. Steinel.
   6. All photo sensors shall be produced by the same Manufacturer and shall be compatible with control equipment.

D. Time Clocks:
   1. Intermatic
   2. Paragon.
   3. Tork.

2.2 MATERIALS

A. General: Furnish and install lighting control devices as indicated on the Drawings.
B. Low Voltage Wiring:
   1. For low voltage wiring, provide wire type as recommended by the Manufacturer.
   2. Adhere to manufacturer's recommendations as to maximum wire length and maximum quantity of relays per switch.

C. Line Voltage Wiring: No. 12 AWG minimum.

D. Occupancy Sensors:
   1. Provide occupancy sensors as indicated herein and on the Drawings.
   2. System Components:
      a. Ultrasonic occupancy sensors.
      b. Passive infrared occupancy sensors.
      c. Dual technology occupancy sensors.
      d. All Occupancy Sensors Shall Include:
         1) Self adjusting type based on algorithm for maximum performance Adjustable time delay 30 seconds to 15 minutes.
         2) Adjustable unit sensitivity.
         3) UL and CBA listed.
         4) 5 year warranty.
         5) Mounting brackets or boxes as required for each space application.
      e. Each Ceiling Mounted Sensor Shall Include:
         1) Power pack and/or slave packs as required.
         2) Additional isolated relay contact for use by the room mechanical systems.
         3) Manual off override if indicated.
         4) LED indicates motion detection.
      f. Device quantities and locations as indicated on the Drawings.
      g. Wiring: As indicated on the Drawings.

E. Ballast Load Transfer Control Relay Device (UL924):
   1. Ballast load transfer control relay device shall operate as follows:
      a. Unit shall comply with NEC and UL924.
      b. Unit operates automatically on a continuous standby mode.
      c. Unit bypasses any electrical control device.
      d. Unit switches load to back-up power when normal power fails with no possibility of current crossover.
      e. Failsafe operation.
      f. Contacts shall be rated for 20 amps ballast load.
      g. Instantaneous operation
      h. Test switch.
      i. LED indicators for normal/emergency mode.
      j. Unit shall be capable to isolate catastrophic faults internally or external of unit.
      k. Unit shall be equipped with surge protection.

F. Photo Sensors (Daylight Harvesting):
   1. Provide photo sensors (daylight harvesting) to be used as an input to the lighting control/dimming system.
   2. Photocells shall be compatible with lighting control system to be used.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Install lighting control devices as indicated on the Drawings.
   2. Install all lighting control devices in accordance with Manufacturer's recommendations.
3.2 FIELD QUALITY CONTROL

A. Contractor Field Service:
   1. Provide qualified personnel to perform, schedule and coordinate: Terminate and label all wiring.

3.3 CLEANING

A. Clean all lighting control system devices at Substantial Completion.

3.4 ADJUSTING

A. Set time delay and sensitivity for all occupancy sensors in accordance with Manufacturer’s written instructions based on room type.

B. Adjust settings as required for all photo sensors (daylight harvesting) for system to function properly and to maximize system performance.

C. For each room/area with a ballast load transfer control relay device, simulate a power outage and test each device to ensure unit is functioning properly and appropriate loads are switched. Make adjustments as required.

END OF SECTION 26 09 23
SECTION 26 24 16 – PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes the furnishing and installation of all distribution panelboards, and lighting and appliance branch-circuit panelboards.

B. Division of Work:
   1. In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the work to be performed by specific trades.
   2. The following are suggestions as to how the Work may be divided. This is not a complete list of all the work:
      a. General Contractor:
         1) Install concrete pads:
            a) As specified herein.
            b) As directed by electrical Subcontractor.
      b. Electrical Subcontractor:
         1) Arrange and pay for all concrete pads.
         2) Coordinate pad location with General Contractor.

1.3 SUBMITTALS

A. Product Data: For each type of panelboard.
   1. Include name of manufacturer and model numbers.
   2. Include materials, switching and overcurrent protective devices, SPDs, accessories and components indicated.
   3. Include dimensions and manufacturers’ technical data on features, performance, electrical characteristics, ratings and finishes.

B. Shop Drawings: For each panelboard and related equipment.
   1. Name of Manufacturer.
   2. Model number.
   3. Details of construction and installation.
   4. Project specific assembly drawings, including elevations, plans, sections, dimensions, weight, and conduit entry locations.
   5. Project specific electrical ratings:
      a. Voltage.
      b. Amperage.
      c. Short-circuit current rating of panelboards and overcurrent protective devices.
   6. Project specific enclosure types:
      a. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges and locks.
   7. Project specific color and finish.
   8. Project specific one line diagram.
   9. Project specific options and accessories.

C. Installation Instructions: For panelboards.
D. Operation and Maintenance Manuals: For panelboards.
1. Equipment function, normal operating characteristics, and limiting conditions.
2. Assembly, installation, alignment, adjustment, and checking instructions.
3. Operating instructions for start-up, routine and normal operating, regulation and control, shutdown, and emergency conditions.
5. Guide to “troubleshooting.”
6. Parts list and predicted life of parts subject to wear.
7. Project specific outline and cross sections, assembly drawings, engineering data, and wiring diagrams.
8. Test data and performance curves.

1.4 QUALITY ASSURANCE
A. Fabrication and Installation Personnel Qualifications:
1. Trained and experienced in the fabrication and installation of the materials and equipment.
2. Knowledgeable of the design and the reviewed submittals.

B. All panelboards and accessories shall bear the UL label.

1.5 DELIVERY, STORAGE AND HANDLING
A. Deliver all materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer’s directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, watertight wrapping.

D. Reject damaged, deteriorated, or contaminated materials and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. 240/120 V AC Maximum:
1. Square D Company: NQ.
4. Siemens Industry, Inc.: Type P1, P2 or P3 Series.

B. All panelboards shall be products of the same Manufacturer.

2.2 MATERIALS
A. General:
1. All panelboards shall have [ aluminum or ] plated copper bus bars and full-sized neutral bar.
3. Bussing Type: Distributed phase.

B. Circuit Breaker Panelboards:
1. Automatic circuit breaker type with individual breaker unit for each circuit, interchangeable, and removable without disturbing adjacent units.
2. Complete front trim with door and flush lock, with 2 keys.
3. Cabinets and fronts shall meet UL Standards for gutter space and material gage.
4. All panelboards shall have common keying.
5. All panelboards shall have a circuit directory frame with plastic cover and card mounted inside cover.
6. Trim for panelboards shall have door-in-door construction with piano hinge. Outer door shall permit full access to the panelboard interior. Inner door shall permit access to breaker operating handles and labeling but current carrying terminals and bus shall remain concealed.

7. Flush mounted double tub panelboards in finished areas shall have a common front cover.

8. Panelboard shall have electrical rating as indicated on the Drawings.

9. Flush mounted panelboards shall have cover flange to overlap cabinet.

10. Finish panelboards in gray enamel over rust inhibitor primer.

11. Branch circuit breakers are to be bolt-on type.

12. Load centers not allowed unless noted otherwise.

C. Short-Circuit Rating: Provide a single integrated rating of each panelboard certifying capability of withstanding fault stresses equal to the lowest interrupting rating of any overcurrent protective device contained in the panelboard.

D. Surge Protective Devices (SPD):
   1. Maximum UL 1449 (3rd Edition), Voltage Protection Rating (VPR):
      a. 208Y/120V and 120/240V Systems:
         1) L-N: 600V.
         2) L-G: 700V.
         3) N-G: 600V.
         4) L-L: 900V.
   2. The branch panel SPD shall be capable of surviving 6,000 ANSI/IEEE, Category C3 (10kA) impulses without failure or degradation of original performance characteristics of more than 10%.
   3. Maximum surge current rating shall be as indicated on the Drawings, based on ANSI/IEEE C62.41 standard 8x20ms current waveform.
   4. The SPD shall be connected to the panelboard bus bar through a dedicated 30 amp breaker provided by the equipment manufacturer.
   5. Warranty: Manufacturer shall provide a product warranty for a period of not less than 5 years from date of installation.

2.3 IDENTIFICATION

A. Panelboard Nameplate: Manufacturer’s name and trademark, voltage, amperage, number of phases, and number of poles shall be located at an accessible location on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Computer-generated, typewritten circuit directory mounted inside panelboard door and placed in metal frame with transparent protective cover.
   1. Circuit directory shall identify specific purpose and location of equipment served with detail sufficient to distinguish it from all other circuits.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which panelboards and enclosures are to be installed and notify Engineer in writing of conditions detrimental to the operation or the proper and timely completion of the work.

3.2 INSTALLATION

A. Anchoring:
   1. Anchor enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secured.
   2. Locate top of enclosures approximately 6'-0" above floor, at a masonry joint if applicable.
   3. Mount free-standing distribution panelboards on 4-inch high concrete pads with 1-inch chamfered edges.
4. Where panelboards are flush mounted, stub four 1-inch empty conduits from panelboard 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, into accessible ceiling space below.

B. Circuit Directories: Upon completion of work, install project specific, computer generated, typewritten circuit directories in all lighting and appliance branch-circuit panelboards.

C. Panelboard Identification Nameplates: Label each panelboard with a nameplate complying with the requirements for identification specified in Division 26 Section “Identification for Electrical Systems.”

D. Device Nameplates: Label each branch circuit device in power panelboards with nameplate complying with requirements for identification specified in Division 26 Section “Identification for Electrical Systems.”

E. Install warning signs complying with requirements in Division 26 Section “Identification for Electrical Systems” identifying source of remote circuit.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

END OF SECTION 26 24 16
SECTION 26 27 26 – WIRING DEVICES

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 furnishing and installation of all wiring devices and the major items listed below:
      1. Receptacles.
      2. Switches.
      3. Wall plates.
      4. Wall box dimmers.
      5. Box covers.

1.3 REFERENCES
   
   A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
      1. NEMA - National Electrical Manufacturer's Association - Standards for general and specific purpose wiring devices WD-1, WD-5.

1.4 SUBMITTALS
   
   A. Shop Drawings: For wiring devices.
      1. Name of Manufacturer.
      2. Model number.
      3. Details of construction and installation.
      4. Electrical specifications and ratings.
      5. Dimensional data.
      6. Color and finish.

1.5 QUALITY ASSURANCE
   
   A. Regulatory Agencies Requirements:
      1. NEC - National Electrical Code (NFPA 70) as applicable to construction and installation of electrical wiring devices.
      2. UL Labels. Provide wiring devices which have been tested and are listed and labeled by Underwriters' Laboratories.

1.6 DELIVERY, STORAGE AND HANDLING
   
   A. Deliver all materials in original, unbroken, brand marked containers or wrapping as applicable.
   
   B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer’s directions.
   
   C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, watertight wrapping.
   
   D. Reject damaged, deteriorated, or contaminated materials and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.
PART 2 - PRODUCTS

2.1 WIRING DEVICES

A. General:
1. Provide factory-fabricated wiring devices in type, color, and electrical rating as indicated on Drawings.
2. Where type and grade are not indicated, proper selection shall be determined by installer to fulfill the wiring requirements and to comply with NEC and NEMA standards for wiring devices.

B. Manufacturers: Provide equal products by one of the following Manufacturers for switches and receptacles specified:
1. Arrow Hart - Cooper Wiring Devices
2. Leviton.
3. Hubbell, Inc.
4. Pass and Seymour - Legrand

C. Wall Plates:
1. Number: Provide a single (switch or duplex outlet) wall plate for wiring devices grouped at each location.
2. Attachment: Provide metal screws for securing plates to devices, screw heads colored to match finish of plate.
3. Construction:
   a. Stainless Steel: 0.04-inch thick, Type 302 satin finished stainless steel, brushed finish, accurately die cut, protected with release paper.
4. Plate Application:
   a. Flush Mounting Devices: Beveled type with smooth edge:
      1) Finished Areas: Stainless steel, plastic. Coordinate with Architectural trades.
      2) Unfinished Areas: Galvanized steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Install wiring devices in accordance with:
   a. The Drawings.
   b. Manufacturer's written instructions.
   c. Applicable requirements of NEC and National Electrical Contractors Association's "Standard of Installation".
   d. Recognized industry practices to ensure that products serve intended function.
2. Delay installation of devices until wiring is completed.
3. Install receptacles and switches only in electrical boxes which are clean and free from excess building materials and debris.

B. Switches:
1. Install as indicated on the Drawings to control lights as indicated.
2. Where more than 1 wall switch is installed in same location, set under 1 cover plate.

C. Wall Box Dimmers:
1. Gang together multiple dimmer switches located at one location.
2. De-rate ganged dimmers in accordance with Manufacturer's instructions.
3. Do not operate on common neutral circuits.

D. Receptacles:
1. Locate approximately as indicated on the Drawings, long dimension vertical, with grounding pole at top.
2. Centerline generally at 18 inches above floor on a tile or block joint unless otherwise indicated on the Drawings. When mounting height exceeds 27 inches above floor, mount horizontally with grounding pole at left.
3. Refer to architectural Drawings for specific location requirements for architectural details when located above counters (long dimension horizontal), and for centering to meet architectural conditions.

4. Refer to mechanical Drawings for coordination with mechanical equipment, radiation, fin tube, grilles, and diffusers.

5. Provide bonding jumper from outlet to box.

E. Corrosion Resistant Receptacles: In areas designated as corrosive areas, install corrosion resistant receptacles, where indicated.

F. Wall Plates:
   1. Install cover plates on all wiring devices.
   2. Plate shall cover entire wall opening.

3.2 FIELD QUALITY CONTROL

A. Testing: Test wiring devices to ensure electrical continuity of grounding connections, and test after energizing circuitry, to demonstrate compliance with requirements.

3.3 PROTECTION OF WALL PLATES AND RECEPTACLES

A. Upon installation of wall plates and receptacles, advise Subcontractors regarding proper and cautious use of convenience outlets. At time of Substantial Completion, replace those items which have been damaged, including those burned and scored by faulty plugs.

END OF SECTION 26 27 26
SECTION 26 28 00 – LOW VOLTAGE CIRCUIT PROTECTIVE DEVICES

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 furnishing and installation of all low voltage circuit protective devices:
1. The types of low voltage circuit protective devices required for the Project and specified in this Section include the following:
   a. Circuit breakers.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
1. UL 489 – Molded Case Circuit Breakers.
2. NEMA AB1 – Molded Case Circuit Breakers.
3. NEMA 250 – Enclosures for Electrical Equipment.

1.4 SUBMITTALS

A. Manufacturer’s literature for each type of low voltage circuit protective device furnished to include:
   1. Name of Manufacturer.
   2. Model.
   3. Time-current curves.
   4. Interrupt ratings.
   5. NEC class.
   6. Details of construction and installation.
   7. Options and accessories.

B. Installation Instructions: For low voltage circuit protective devices.

C. Operation and Maintenance Manuals: For low voltage circuit protective devices.
   1. Equipment function, normal operating characteristics, and limiting conditions.
   2. Assembly, installation, alignment, adjustment, and checking instructions.
   3. Operating instructions for start-up, routine and normal operating, regulation and control, and shutdown.
   5. Guide to “troubleshooting.”
   6. Parts list and predicted life of parts subject to wear.
   7. Project specific outline and cross sections, assembly drawings, engineering data, and wiring diagrams.
   8. Test data and performance curves.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed submittals.

B. Provide circuit breakers which have been tested, listed, and labeled by Underwriters’ Laboratory.
1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer’s directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, watertight wrapping.

D. Reject damaged, deteriorated, or contaminated materials and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 FUSES

A. General: Provide fuses manufactured by Bussmann, Inc. as required for all motor starters, fused disconnect switches, and other equipment requiring fuse protection as indicated on the Drawings, or in absence thereof, as selected by the installer to meet the specific electrical requirements of the equipment being served. Select only from the following:

1. Dual element fuse, 0-600 ampere, 250 or 600 volt, 200,000 ampere interrupting rating, Type R-K5: Buss “Fusetron”.

B. All fuses shall be by one Manufacturer.

2.2 CIRCUIT BREAKERS

A. General:

1. Provide required circuit breakers for installation in panelboards, switchboards, individual enclosures, or motor control centers. Circuit breaker Manufacturer shall be that of the equipment in which it is installed or shall be supplied by that equipment Manufacturer.
2. All breakers shall be rated for the applied voltage and have a minimum 10,000-amp interrupt rating.

B. Mechanism: Molded case circuit breakers shall have over center toggle-type mechanisms, providing quick-make, quick-break action. Breakers shall be calibrated for operation in an ambient temperature of 40 degrees C. Each circuit breaker shall have trip indication by handle position and shall be trip-free. 2 and 3 pole breakers shall be common trip.

C. Thermal Magnetic Trip:

1. Each circuit breaker shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.
2. Circuit breakers with frame sizes greater than 100 amperes shall have variable magnetic trip elements which are set by a single adjustment (to ensure uniform tripping characteristics in each pole).
3. Single pole 15 and 20 ampere breakers shall be SWD rated.

4. Manufacturer:
   a. Square D.
   b. General Electric.
   c. Cutler Hammer.

D. Enclosures:

1. Provide a UL listed circuit breaker enclosure for each individually mounted circuit breaker.
2. Enclosure to have NEMA rating for its intended location (NEMA 12, 3R, 4).
3. Provide handle mechanism padlockable in “OFF” position.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses in all combination motor starters, fused disconnects, and equipment as required. Install circuit breakers in all panelboards, switchboards, and motor control centers as required.

3.2 FIELD SETTINGS

Contractor shall perform field adjustments of protective devices as required to place the equipment in final operating condition.

END OF SECTION 26 28 00
SECTION 26 28 20 – ENCLOSED SWITCHES

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 furnishing and installation of all switching devices or means of disconnecting motors and other electrically powered equipment.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with NEMA - National Electrical Manufacturers Association: Standard KS1 for enclosed switches.

1.4 SUBMITTALS

A. Shop Drawings: For disconnect switches.
   1. Name of Manufacturer.
   2. Model number.
   3. Details of construction and installation.
   4. Assembly drawings, including elevations, plans, sections, dimensions, weight, and conduit entry locations.
   5. Electrical Ratings:
      a. Voltage.
      b. Amperage.
      c. Interrupt rating.
      d. Enclosure type.
   6. Color and finish.
   7. Options and accessories.

B. Installation Instructions: For disconnect switches.

C. Operation and Maintenance Manuals: For disconnect switches.
   1. Equipment function, normal operating characteristics, and limiting conditions.
   2. Assembly, installation, alignment, adjustment, and checking instructions.
   3. Operating instructions for start-up, routine and normal operating, regulation and control, shutdown, and emergency conditions.
   5. Guide to “troubleshooting.”
   6. Parts list and predicted life of parts subject to wear.
   7. Project specific outline and cross sections, assembly drawings, engineering data, and wiring diagrams.
   8. Test data and performance curves.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed submittals.
Enclosed Switches

Section 26 28 20

Wayne State University
Prentis Building Computer Lab Relocation
WSU Project Number 022-313456
FTCH Project Number 180746

B. Regulatory Agencies Requirements:
   1. Comply with National Electrical Code (NFPA 70) as applicable to construction and installation of electrical disconnect switches.
   2. Provide disconnect switches which have been listed and labeled by Underwriters' Laboratories.
   3. Comply with OSHA lockout/tagout requirements.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in original, unbroken, brand marked containers, or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer's directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, watertight wrapping.

D. Reject damaged, deteriorated, or contaminated materials and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 FABRICATED SWITCHES

A. Manufacturers: Provide products produced by one of the following Manufacturers (for each type of switch):
   1. Square D Company.
   2. General Electric.

B. General:
   1. Provide heavy duty disconnect switches for all motors and equipment as indicated on the Drawings.
   2. Provide disconnect switches for all motors not in sight of supplying distribution panel whether indicated on the Drawings or not, as required by NEC.

C. Switch Enclosures: Provide disconnect switches with NEMA enclosures 1, 3R, 4X, 7, or 12 as indicated on the Drawings, or in absence thereof, as determined by installer to fulfill the requirements of the environment.

D. Heavy Duty Safety Switches:
   1. Provide heavy duty type, sheet steel enclosed safety switches, of the type and size and electrical characteristics indicated, surface mounted, fusible or nonfusible, rated at 250 volts, 60 hertz, 3 blades, incorporating quick-make, quick-break type switches, constructed so switch blades are visible in "off" position with door open; equipped with operating handle which is an integral part of the enclosure base and whose position is easily recognizable and is padlockable in the "off" position; with current carrying parts constructed of high-conductivity copper, and silver-tungsten type switch contact; with positive pressure type reinforced fuse clips.
   2. Fuse clips shall accept only Class R type fuses.
   3. All disconnect switches shall be horsepower rated.

E. Switch Interlock:
   1. Provide switches with dual cover interlock to prevent opening door with switch in "on" position or closing switch with door open.
   2. Interlocks shall be defeatable with the use of a screwdriver to intentionally gain access to an energized switch in the "on" position.
PART 3 - EXECUTION

3.1 INSPECTION

A. General:
   1. Examine the areas and conditions under which disconnect switches are to be installed and notify
      Engineer in writing of conditions detrimental to the proper and timely completion of the work.
   2. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable
      to Engineer.

3.2 INSTALLATION

A. General: Install disconnect switches where indicated, in accordance with Manufacturer's written instructions,
the applicable requirements of NEC and the National Electrical Contractors Association's "Standard of
Installation", and in accordance with recognized industry practices to ensure that products serve the intended
function.

B. Coordination: Coordinate disconnect switch installation work with electrical raceway and cable work, as
necessary for proper interface.

C. Location:
   1. Install disconnect switches used with motorized equipment within sight of the controller position unless
      otherwise indicated.
   2. Mount on wall whenever possible, otherwise provide supporting device adjacent to equipment being
      served.

D. Fuses: Provide fuses for disconnect switches in accordance with Division 26 Section “Low Voltage Circuit
Protective Devices.”

END OF SECTION 26 28 20
SECTION 26 50 00 – LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the furnishing and installation of all lighting and the major items listed below:
   1. Interior luminaires.
   2. Ballasts.
   3. Lamps installed in luminaires.
   4. Emergency lighting.
   5. Exit signs.
   6. Luminaire supporting systems.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ANSI-UL Standards:
      a. 924 - Emergency Lighting and Power Equipment.
      b. 935 – Fluorescent-Lamp Ballasts.
      c. 1598 – Luminaires.
   2. FCC Rules.

1.4 SUBMITTALS

A. Shop Drawings: For luminaries.
   1. Luminaire designation.
   2. Name of Manufacturer.
   3. Model number.
   4. Details of construction and installation.
   5. Dimensions and rough-in requirements.
   6. Voltage.
   7. Ballast Data:
      a. Name of Manufacturer.
      b. Model number.
      c. Operating characteristics
   8. Wiring diagrams.
   9. Color and finish.
   10. Options and accessories.

B. Sworn affidavit of luminaire conformance to State Fire Safety Board rules. Operation and Maintenance Manuals: For luminaires.
   1. Equipment function, normal operating characteristics, and limiting conditions.
   2. Assembly, installation, alignment, adjustment, and checking instructions.
   3. Operating instructions for start-up, routine and normal operating, regulation and control, shutdown, and emergency conditions.
   5. Guide to “troubleshooting.”
   6. Parts list and predicted life of parts subject to wear.
   7. Project specific outline and cross sections, assembly drawings, engineering data, and wiring diagrams.
   8. Test and performance curves.
C. Submit 2 copies of Record Drawings to Owner identifying maintenance and lamp replacement requirements.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed submittals.

B. All equipment shall be UL listed.

1.6 WARRANTY

A. In accordance with the warranty provisions defined in the General Conditions and Supplementary Conditions:
   1. Includes all ballasts.
   2. Does not include lamps.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer’s directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, watertight wrapping.

D. Reject damaged, deteriorated, or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers: Provide Manufacturer’s listed in the luminaire schedule.

B. General:
   1. Furnish and install all luminaires with lamps as indicated on the Drawings and as listed on the Luminaire Schedule.
   2. Furnish luminaires with all trims and accessories required for the various types of ceiling and wall construction.
   3. All ballasts used in fluorescent luminaires shall be Class "P" rated, high power factor, CBM certified and UL listed.
   4. All ballasts shall have an "A" sound rating, where available.
   5. Provide "damp" or "wet" location labels on all luminaires installed outdoors and in damp or wet interior locations.
   6. All recessed luminaires shall be thermally protected.
   7. Provide low temperature ballasts for all luminaires installed outdoors or in unheated interior spaces.
   8. All fluorescent troffers shall be painted after fabrication.
   9. All indoor luminaire diffusers shall conform with the Department of State Police, State Fire Safety Board, and School Fire Safety rules.

C. Exit Signs:
   1. Provide exit signs as indicated on the Luminaire Schedule.
   2. Include lamps with the exit signs.
   3. Exit signs shall have minimum of 6-inch high letters with directional arrows as indicated on the Drawings.

D. LED’s: Provide LED’s as provided from the manufacturer listed in the Luminaire Schedule.
PART 3 - EXECUTION

3.1 PREPARATION

A. Examine all pertinent details (architectural and otherwise) in the Contract Documents that are relevant to the installation of luminaires.

3.2 INSTALLATION

A. General:
1. Install surface mounted, recessed, or semi-recessed luminaires to maintain the alignment, spacing, layout, and general arrangement indicated on the Drawings.
2. Obtain approval of Engineer for all proposed changes that may be required due to field conditions and/or to avoid conflicts with Work by other trades.
3. Install all luminaires in accordance with Manufacturer's recommendations.
4. Equip all luminaires with the specified quantity of functional lamps prior to Substantial Completion.
5. Install all wiring for emergency lighting and exit signs that are not local battery powered in a raceway system independent from other building wiring.

B. Coordination:
1. Coordinate locations of recessed and surface mounted luminaires in ceiling systems with Division 09.
2. Locate luminaires according to the reflected ceiling Drawings, if furnished.
3. Coordinate location of luminaires in Mechanical HVAC and Plumbing areas with other trades.
4. Notify Engineer of field conditions that contradict plans or specifications prior to beginning work.
5. Coordinate space conditions that contradict or conflict with Work by other trades before installing luminaires.

C. Mounting and Support:
1. Recessed LED Luminaires:
   a. Wire luminaires that are mounted in or on the underside of lay-in ceilings with flexible conduit to an outlet box on the rigid conduit system above, such that the rigid conduit system does not interfere with the removal of lay-in ceiling panels or luminaires.
   b. Do not support luminaires directly on ceiling panels.
   c. Install a minimum of four ceiling support system rods or wires for each luminaire. Locate rods or wires not more than 6-inches from the corners of each luminaire.
   d. Support Clips: Fasten to each luminaire and to ceiling grid members at or near each luminaire corner with clips that are UL listed for the application.
   e. Securely mount luminaires and electrical boxes to elements of the building structure such that luminaires will be square, plumb, and rigid; and will not fall or sag, and will not cause the suspended ceiling system to fall or sag.
   f. Install at least one independent support rod or wire from structure to a tab on each luminaire. Wire or rod shall have a breaking strength equal to the weight of luminaire plus a safety factor of 3.
   g. Provide all additional means (metal plates, etc.) necessary to support luminaires that would put excessive stress on the ceiling system.
2. Surface Mounted Luminaires:
   a. Securely mount luminaires and electrical boxes to elements of the building structure such that luminaires will be square, plumb, and rigid; and will not fall or sag, and will not cause the ceiling system to fall or sag.
   b. Provide all additional means (metal plates, plywood backing, expansion bolts, toggle bolts, etc.) necessary to support luminaires that would put excessive stress on the ceiling system.

3.3 FIELD QUALITY CONTROL

A. Test all luminaires, lighting controls, and emergency lighting systems for proper operation.

B. All luminaires, exit signs, and emergency lighting systems shall operate properly.
C. Adjusting and Aiming:
   1. All final adjusting and aiming of luminaires (such as focusing all adjustable luminaires) shall be done during the night hours. Contractor shall prearrange time with Engineer so Engineer and Owner can be present. Final adjustments shall be made as directed in field by Engineer.
   2. Replace all defective LED’s and drivers immediately prior to Substantial Completion.

3.4 CLEANING

   A. Clean all luminaire trims, exposed housings, doors, lenses, and reflectors immediately prior to Substantial Completion.

END OF SECTION 26 50 00
SECTION 27 10 00 – COMMUNICATIONS OVERVIEW

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 furnishing and installation of all lighting and the major items listed below:

1. This section provides a project overview and general project and Contractor requirements.
2. The “Contractor” as referred to in these specifications, shall be the bidder whose bid is eventually chosen as the winner.
3. The “Engineer” as referred to in these specifications, shall be FTCH and its representative on this project.
4. The “Owner” as referred to in these specifications, shall be the Wayne State University and its representatives.
5. In the detailed specifications and on the contract drawings, the phrases “or equivalent,” “approved equivalent,” “approved equal,” “or equal” and “engineer approved equivalent” shall be used interchangeably and shall mean the same thing.
6. All equals, equivalents, or alternates shall be approved by the Engineer prior to ordering or installation. Without approval, deviation from the products listed in the specifications and on the drawings shall be presumed to be nonconforming and shall be removed and replaced at the direction of the Engineer and at the Contractor’s expense.

1.3 DESCRIPTION OF PROJECT

A. Cabling and Communications Infrastructure:

1. The communications portion of the project encompasses communications cabling and termination equipment and communications room racks and cabinets. The extent of the work shall be as shown on the drawing and detailed in these specifications.
2. Communications Cabling and Termination Equipment:
   a. All user UTP cabling shall be CAT-6E cable that is plenum rated.
   b. User cables shall be labeled according to the drawings and the specifications.
   c. All cables shall be terminated and tested as per the specifications.
   d. Provide two patch cords per data cable. Refer to drawings and specifications for size and color.
3. Provide complete build out of one communications room, including racks, wall fields and cable tray.
4. Contractor shall provide personnel and equipment for full training and commissioning of the system.
5. All cables shall be supported by approved supports.

1.4 STORAGE OF MATERIALS

A. All materials shall be secured when not in use by the Contractor.

B. It shall be the Contractor’s responsibility to secure all equipment including all material to be installed as part of the contract. No changes shall be made to the contract due to loss or theft of equipment and materials not officially accepted by the Owner.

1.5 SHOP DRAWINGS

A. Shop drawings shall be submitted for approval by the Contractor and approved by the Owner prior to final installation of the work. The shop drawings shall show all data relating to the structural, electrical, wiring diagrams, etc.
Communications Overview

1.6 REFERENCE SPECIFICATIONS

A. All work applicable shall conform to the following standards:
   1. ANSI/TIA/EIA-568-C.0 Generic Telecommunications Cabling for Customer Premises.
   2. ANSI/TIA/EIA-568-C.1 Commercial Building Telecommunications Cabling Standard.
   4. EIA/TIA-569-A: Commercial Building Standard for Telecommunications Pathways and Spaces including all Updates and Addenda.
   5. EIA/TIA-570-A: Residential and Light Commercial Telecommunication Wiring Standard including all Updates and Addenda.
   6. EIA/TIA-606-A: Administration Standard for the Telecommunications Infrastructure of Commercial Buildings including all Updates and Addenda.
   10. TIA/EIA-526-14-A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant.

1.7 CONTRACTOR CABELING

A. The Contractor shall have a BICSI certified Registered Communications Distribution Designer (RCDD) identified that will be responsible for all aspects of the installation. (This person does not have to be a direct employee of the bidder but must inspect the work to ensure that it is done based on standards).
   1. The resume of the RCDD, and a list of past projects the RCDD has worked on, shall be submitted with the bid response. The Engineer reserves the right to reject the RCDD, and require the Contractor to assign another if the RCDD is found not to have sufficient experience in projects of relatively the same scope.
   2. If during the course of the work, the Contractor changes the RCDD assigned to the project, the Contractor shall provide the resume of the new RCDD and a list of projects of similar scope the new RCDD has worked on.

B. The Contractor shall show proof of an existing contractual relationship with the approved equipment manufacturer of the horizontal cabling system, and shall pass through the manufacturer's certification to purchaser.

C. All faceplates and termination hardware shall be sourced from the certifying manufacturer to assure quality control and validity of the manufacturer's warranty.

D. The Contractor shall accept complete responsibility for the installation, certification, and support of the cabling system. Contractor must show proof that he has the certifying manufacturer's support on all of these issues.

E. All work shall be performed and supervised by Telecommunications Technicians and Project Managers who are qualified to install voice, data, and image cabling systems, and to perform related tests as required by the manufacturer in accordance with the manufacturer's methods.

F. The Telecommunications Technicians employed shall be fully trained and qualified by the manufacturer on the installation and testing of the equipment to be installed. Evidence that the vendor is a current Certified Installer of the manufacturer must be provided in writing prior to work commencing on the structured cabling for the building.
G. The Contractor (including Subcontractor(s) if any) shall have a proven track record in cabling projects. This must be shown by the inclusion of details of at least 3 projects involving Category 6 or better cabling and optical fiber, which have been completed by the vendor in the last 2 years. Names, addresses, and phone numbers of references for the 3 projects shall be included. The installing contractor for each communication system shall have a minimum of 5 years of experience with the types of systems specified. A company employee must be certified to install, test and warranty; the product specified prior to a bid submittal. No exception to this will be allowed.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Contractor shall be familiar with the location(s) where the work will be done. No additional compensation will be made for items the Contractor claims he was not aware of during bidding.

B. Work Area:
   1. All work areas shall be cleaned at the end of each day. All debris shall be cleaned and removed from the site and disposed of in the approved container for the site.
   2. All equipment shall be moved out of common areas and stored in the Contractor’s lay down area, or in other approved storage locations on Site.
   3. Any work that is low hanging, or may otherwise impede the general use of the space, and cannot be removed, shall be flagged and cordoned off by the Contractor.

C. All equipment and parts shall be installed in a neat and workmanlike manner. Good installation principles shall be used throughout the project.

D. All cables routed above the drop ceiling or in the ceiling area shall be installed square to the building. Diagonal cable runs are not permissible.

E. All cut edges of conduits, boxes, raceway, etc., shall be trimmed and filed so that no burrs or rough edges will damage cable as it is installed.

F. All surface raceways, including conduits in exposed areas shall be painted to match the existing colors of the surrounding area.

G. If in the course of the work, the Contractor damages, marks, or misplaces any ceiling tiles, the Contractor shall repair, and/or replace the ceiling tile to the original condition.
   1. The Engineer shall decide if ceiling tiles have been damaged. Based on the Contractors proposed fixes, the Engineer shall decide the best course of action to repair any damage done by the Contractor to the ceiling tiles.

H. It shall be the responsibility of the Contractor to repair any damage done to the structure or finishes in the building by the Contractor. The building shall be returned to its original condition prior to final sign off of the project.

3.2 DOCUMENTS

A. The Contractor shall fully read the contract documents including the detailed specifications, and the detailed drawings.

B. No additional compensation shall be made for any portion of the project which the Contractor did not know of or understand prior to providing the bid response.
C. In the case of any discrepancies between the detailed drawings and the detailed specifications, the Contractor shall provide the higher quality or more stringent requirement.

3.3 WORK PLAN-POST BID (CHOSEN CONTRACTOR ONLY)

A. Along with the submittals the Contractor shall provide a work plan for the implementation of the complete system. The plan shall include scheduled dates for major milestones, and all phases required for completion prior to final cutover.

B. The work plan shall list all items that must be completed by the Contractor or Owner to provide a smooth install of the system. The Contractor shall be responsible for all costs associated with the planning and cutover. The Owners only responsibility is to act as a liaison between the Contractor and the users.

C. The work plans shall include a time line and a cutover date for the systems. Contractor shall be responsible for all aspects of scheduling the work, including notification of the users, the administration, and any service provider.

D. The work shall commence within 10 days of award of the contract. The Contractor shall be responsible for attending weekly project meetings at the Owner's site to report on progress and keep the project team informed of the work being done.

E. The work plan will be reviewed at each weekly meeting for compliance and updates.

F. Work shall immediately begin on site surveys to determine the existing infrastructure and determining placement of new equipment. The Contractor shall be responsible for moving, relocating, and reconnecting any and all existing equipment required for the installation of the new systems.

G. After work plan and system approval by the Engineer the Contractor can begin work on infrastructure work that does not impede users.

H. The Contractor shall be responsible for working with the Owner’s Information Technology staff and administrators.
   1. Before commencement of work, the Contractor shall provide Installer Certificates as required by Division 01 Section “Submittal Procedures”, Paragraph 2.2 E.

END OF SECTION 27 10 00
SECTION 27 11 50 – COMMUNICATIONS GROUNDING

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 SECTION INCLUDES

A. This section includes parts and equipment required for a complete telecommunications grounding system installation and test.

1.3 SYSTEM DESCRIPTION

A. The grounding system from the ground bar in each communications room to the electrical ground shall be installed by the Electrical Contractor. This shall include ground bars in each communications room, ground cables in the cable tray, ground connections to electrical panels, and grounding of any riser conduits.

B. Telecommunications grounding systems shall be connected to the electrical ground at the Main Distribution panel.

C. Refer to: NFPA 70-99, National Electrical Code and NEC Section 800

D. Refer to EIA/TIA-607A.

1.4 COORDINATION

A. Coordinate work under provisions in Division 1 of these specifications.

B. Coordinate ground connections to ground bar with Electrical Engineer and Contractor.

C. Coordinate the location of ground bars in the communications room with the Electrical Contractor prior to installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Approved equals for ground components are:
   1. Newton.
   2. Erico.
   3. Hubbell.
   4. Panduit.

2.2 MATERIALS

A. Ground Bar shall be as detailed on the drawings.

B. Compression (crimp) type ground lugs for connection of ground cables shall be Burney No. YCA series or equivalent.
   1. Use only manufacturer approved crimp tools with all crimp lugs.
C. Ground wire shall be No. 6 AWG for all ground connections from the equipment to the ground bar. Ground wire in plenum areas shall be bare with no insulation. All other ground wires shall have green insulation.
   1. Approved ground cable vendors are Southwire, The Okonite Company, and Pirelli; or equal.

**PART 3 - EXECUTION**

3.1 EXAMINATION

A. Location of the ground bar shall be finalized in the communications room prior to installation.

B. Locate and note all equipment to be connected to the ground system. Routes for ground cables shall be planned prior to final location of the ground bar.

C. Identify location of racks, cabinets, and all electronic equipment. Connections from the ground bar to all of these are required for a complete ground system.

D. Connect the cable ladder to the ground bar in each communications room. Connect with a #6 AWG ground cable.

3.2 PREPARATION

A. Plan routes of all ground cables.

B. For components that are to be connected to the ground system, remove paint from the connecting point and attach to the ground cable with a star washer.

C. Ground cables shall be connected from the ground bar in each communications room with a No. 6 AWG ground cable. Items to be connected by the Communications contractor include, but are not limited to:
   1. Racks and cable ladder.
   2. Cable tray.
   3. Protected entrance terminals (PET).
   4. Splice cases.
   5. Data networking equipment.
   6. Cabinets.

3.3 INSTALLATION

A. Install the ground bar to the wallfield.
   1. Coordinate location with other systems.
   2. Work with Electrical contractor to have them connect the ground bar to the electrical service panel and building steel.

B. Ground connections shall meet all applicable codes, and shall be located such that they are accessible for maintenance.
   1. All grounding conductors shall be continuous without splice.
   2. All grounding electrodes and all metallic piping systems shall be bonded together. In no instance should local metallic piping systems be depended upon as the sole means of grounding the communications system.
   3. Metal boxes, cabinets and fittings, or noncurrent carrying metal parts of other fixed equipment, if metalically connected to grounded cable armor or metal raceway, are considered to be grounded by such connection. If not connected, they shall be grounded in 1 of the following ways:
      a. By a grounding conductor run with circuit conductors, this conductor may be uninsulated. But if it is provided with an individual covering, the covering should be finished to show a green color.
      b. By a separate grounding conductor installed the same as grounding conductor for conduit and the like.
4. Metal raceways, cable armor, cable sheath, enclosures, frames, fittings, and other metal noncurrent carrying parts that are to serve as grounding conductors shall be effectively bonded where necessary to assure electrical continuity and the capacity to conduct safely any fault current likely to be imposed on them. Any nonconductive paint, enamel, or similar coating shall be removed at threads, contact points, and contact surfaces or be connected by means of fittings so designed as to make such removal unnecessary.

5. Continuity of metal raceway or metallic sheathed cable shall be assured throughout the system.

6. National electrical code shall be used as guide for grounding in hazardous areas.

C. Ground cables shall be installed in a neat and workmanlike manner.
   1. All cables shall be supported or routed against a wall and attached to the wall. No free floating cables between components will be allowed.
   2. Fully support ground cable so that it does not sag between connections.
   3. There shall be no sharp bends in the ground cables.

D. Terminate and connect all ground cables with crimp type connectors.
   1. Use star washers on all connections of ground cables to ground bars and racks and equipment.

E. Ground systems shall be tested after installation to ensure proper installation and connectivity.
   1. Test procedures shall be fully spelled out. They shall minimally include, the time and date of the test, name of tester, device used to test ground potential, and test results.
   2. The Contractor shall provide test results, to the Engineer for final approval and sign off.
   3. Ground connections shall be tested at each rack in each communications room. The system shall not be considered complete until the ground tests have been completed and acceptable results are provided.

END OF SECTION 27 11 50
SECTION 27 15 00 – FIBER CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. This section includes parts and equipment required for installation, termination and testing of a fiber optic cable backbone.

1.3 SYSTEM DESCRIPTION

A. The fiber optic backbone shall include all components of the system from the patch panels to the backbone fiber and everything in between.

1.4 COORDINATION

A. Coordinate work under provisions in Division 1 of these specifications.

B. All fiber cables shall be coordinated with the installation of the telecommunications raceways.

C. Coordinate location of the spare coiled fiber cables with Engineer prior to installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Approved vendors for fiber cable and termination equipment are:
   2. Corning.
   4. Systimax.

2.2 MATERIALS

A. All fiber cables shall be of tight buffered construction. A tight buffered optical fiber shall consist of a central glass optical fiber surrounded by a primary polymer buffer and an optional tight fitting secondary buffer.
   1. The outer jacket of each fiber strand shall be colored according to the fiber color code in TIA 598-B.
   2. Individual multimode fiber strands shall be 50/125μm for the core/cladding measurements.
   3. Individual singlemode fiber strands shall be 9/125μm for the core/cladding measurements.
   4. All fiber strands shall be surrounded by synthetic yarn for added strength and crush resistance.
   5. All fiber installed in plenum rated areas shall be UL listed OFNP.
   6. The outer jacket of the cable shall be surface printed with the manufacturer's identification and required UL markings.
   7. All fibers shall be subjected to a minimum fireproof stress of 0.7 GPa (100 kpsi).
   8. The minimum bend radius of the cable under full rated tensile load shall be no larger than 15 times the outside diameter of the cable and no more than 10 times the outside diameter of the cable with no load on the cable.
   9. Optical and mechanical performance shall not be degraded and the cable shall not be damaged in any way by immersion in ground water.
   10. The fiber optic cable shall meet or exceed the requirements of this specification when measured in accordance with the methods of the individual requirements or the following methods as defined in EIA-STD-RS-455.
a. Fiber dimensions.
b. Attenuation.
c. Bandwidth.
d. Numerical aperture.
e. Fiber proof test.
f. Cable bending.
g. Tensile load.
h. Impact resistance.
i. Crush resistance.
j. Attenuation vs. temperature.

11. Manufacturer shall provide ISO 9001 certification.
12. The cable shall withstand an impact force 1500 times per ANSI/TIA/EIA-RS-455 (FOTP-25A).
13. The cable shall withstand compression load of 1800 N/cm per ANSI/TIA/EIA-RS-455 (FOTP-41A).
14. Fiber shall be indoor/outdoor rated based on the areas in which the fibers will be installed. Do not install riser rated fiber through a plenum rated area unless the fiber is inside an EMT conduit.

B. Indoor Rated type fiber shall be. Corning FREEDM series fiber cables or equal.
1. The multi-fiber cables shall consist of tight buffered optical fibers surrounded by a synthetic yarn strength member and a color coded flame retardant elastomeric polymer jacket. The strength member shall be composed of individually and precisely tensioned elements such that tensile loads are equally shared by each element.
2. 12 strand multi-mode plenum rated fiber cable shall be Corning # 012T8P-31180-29 and Aqua in color. OM3 fiber cable.
   a. Wavelength: 850/1310nm
   b. Industry Standard: OM3
   c. 1 Gigabit Ethernet Distance: 750/600 meters
   d. 10 Gigabit Ethernet Distance: 150/300 meters
   e. Max Attenuation: 3.0/1.0 dB/km
   f. Laser Bandwidth: 950/500 MHz-km
3. 12 strand single-mode plenum rated fiber cable shall be Corning #012E88-33131-29 and yellow in color.
   c. 1 Gigabit Ethernet Distance: 5 km.
   d. 10 Gigabit Ethernet Distance: 10 km.
   e. Max Attenuation: .5/.5 dB/km.

C. 3U rack mount fiber patch panels shall be Corning # CCH-03U or equal.
1. Rack mount fiber patch panels shall be modular in design. Mounting brackets shall be provided for 12 pack adapters. Adapter packs shall sit horizontally in the panel.
2. Panels shall mount into standard 19 inch relay racks.
3. Panels shall be no more than 1-3/4 inch or 1 rack unit high.

D. 12-pack adapter panels shall be installed in each fiber panel for termination.
1. Adapters shall support 12 fibers each.
2. Adapters shall sit horizontally in the fiber panels.
3. SC 12-pack adapters for fibers shall have connectors, Corning #CCH-CP12-59 or equal.

E. Contractor company shall have a minimum of 3 years experience installing and testing fiber optic cabling systems.
1. Unless otherwise specified, multimode and single mode fiber cable must meet the transmission performance parameters as specified in ANSI/TIA/EIA-568-B.3.
2. Test equipment used under this contract shall be from manufacturers that have a minimum of 5 years experience in producing field test equipment. Manufacturers must be ISO 9001 certified.
4. Traces and records shall be provided to the Engineer and Owner in hard (paper) and soft (disk) copy.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine all pathways prior to installation of fiber cable.

B. Identify location of racks, and position of fiber patch panels prior to fiber installation.

C. Inspect fiber cable prior to installation for damage during shipping. The Contractor shall be responsible for all damaged or nonfunctional fiber cables. If any strands of a fiber cable are not working, the Engineer has the right to order the complete replacement of the entire fiber cable.

3.2 PREPARATION

A. Contractor shall designate the location of the spare coil of fiber at each end of the run prior to installation.

3.3 INSTALLATION

A. Installation of fiber cable shall be by a trained installer.
   1. All fiber, if not installed inside cable tray, shall be attached to the building structure with conduit clamps or supports a minimum of every 5 feet.
   2. Fiber shall be continuous from end to end, no splices are allowed unless specifically noted. Single mode pigtails spliced at each end of the fiber are allowed.
   3. At each termination point of the fiber, the Contractor shall provide a service coil consisting of a minimum of 30 feet of fiber cable. This coil shall be stored on the wall in a stowage ring, Leviton No. 48900-OFR.
   4. Contractor shall adhere to all manufacturer’s recommended pull tensions during installation.
   5. As part of the as-built drawings, provide the actual footage of each fiber cable installed. Mark this on the drawings.
   6. Any fiber strands that do not pass a sufficient signal light signal will be identified as noncompliant, and the Engineer has the right to order the complete replacement of the fiber cable by the Contractor.
   7. Where fiber cable passes vertically through a building, the fiber cable shall be supported against the wall or from the ceiling a minimum of every 5 feet.
   8. Do not exceed recommended bend radius of fiber cable during or after installation.

B. Fiber patch panels shall be located at the top of the relay rack or cabinet at which they are installed.
   1. Provide patch panels as described on the contract drawings or additional panels as required to terminate all fiber strands of all fiber cables.
   2. Install fiber panels in the top of the rack, and install them in the rack closest to the wall.
   3. If a splice shelf is required for splicing of singlemode fibers, install the shelf directly below the associated patch panel.
   4. Route fiber cable into side of the panel. If the cable has single and multimode fibers, route the subgrouped singlemode fibers to the splice shelf below.
   5. The sheath of the fiber cable shall extend to the side of the panel. Individual fibers or subgroups shall not be seen outside of the panel, except for the single mode bundles.
   6. Fibers shall be installed in the adapter packs in color code order. For vertical mounted 6 pack adapters, top to bottom then left to right. In panels where the couplers are horizontally mounted, left to right for each 6 pack, then top to bottom. Contact the Engineer with any questions.
   7. All individual fiber strands shall be neatly installed in the back of the panel after termination. Provide a minimum of 4 feet of spare fiber in the back of each panel. This spare shall be coiled in a Figure 8.
   8. All fibers shall be neat and orderly.
   9. Label the fiber cable just outside of the fiber panel with a yellow fiber optic cable label, Panduit No. PST-FO.
   10. Secure the fiber to the entrance of the patch panel with tie wraps.
   11. After installation and termination of the fiber cable, install labels on the patch panel showing what strand each connector is connected to, and where the overall fiber cable is terminated at the other end.
   12. Attach a self-adhesive clear plastic sleeve to the inside of the plexiglas cover of the panel. Slide in a laser printed label showing all information about the fiber cable.
C. Connectors shall be SC type.
   1. SC connectors shall be installed with a 2 part anaerobic adhesive.
   2. Properly clean and cleave the fiber strand prior to inserting into the connector.
   3. Use only 99 percent pure isopropyl alcohol, and lint free pads to clean the fiber before and after termination.
   4. Apply adhesive in a clean environment to minimize dust and other contaminants.
   5. Install all boots and strain relief devices provided with the connector to provide a more rigid connection between the fiber and the connector.
   6. After insertion, use only a high quality, cleaving device.
   7. The polishing of the cleaved fiber, after insertion into the connector shall be via a 3 step polishing process, utilizing at least 3 different grades of polishing paper.
   8. Visually inspect the end of each terminated and polished fiber with a lighted scope. The fiber shall look completely matched to the connector, and completely polished. No nicks or shatters of the fiber shall be allowed.

END OF SECTION 27 15 00
SECTION 27 16 00 – CAT-6 CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. This section includes parts and equipment required for installation, termination, and testing of user communications cables.

1.3 SYSTEM DESCRIPTION

A. The horizontal cabling consists of all systems from the user faceplate, to the patch panel in the communications room, and all connections in between.

B. Products and installation detailed in this section shall comply with all applicable requirements.
   1. ISO 11801.
   2. ANSI/TIA/EIA-568-C.0 Generic Telecommunications Cabling for Customer Premises.
   5. ANSI/TIA/EIA-569-A Pathway and Spaces.
   8. FCC 47 CFR 68.
   9. NEMA – 250.
   10. NEC – Articles 770 and 800.

1.4 COORDINATION

A. All cables shall be coordinated with the installation of the telecommunications raceways.

B. Coordinate all user cables with the furniture to be installed in the building. Make any adjustments prior to cable being installed.

C. Contractor shall walk the site during construction and shall verify all raceways are being installed as required to install the user data cables. Walk the site prior to drywall being installed or floors being installed when Floor boxes are being installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Approved vendors for copper station cables and connectivity are:
   1. Belden DataTwist 600e.
   3. CommScope Uniprise 7504 Cat6E.
   4. Hubbell NEXTSPEED Cat 6 enhanced.
   5. Superior-Essex/Ortronics NextGain Cat6EX.
2.2 MATERIALS

A. All UTP user/cabling installed shall be “Enhanced” CAT-6 rated or above.
1. Category 6 cabling shall consist of 4 pairs of unshielded twisted pair, 23 AWG cables.
2. Cables shall meet all requirement of TIA/EIA 568C.2 and all updates.
3. All CAT-6 cables shall be installed in cable tray or supported by J-Hooks.
4. Individual pair shall be marked in the standard 4 pair color code of blue/blue-white, orange/orange-white, green/green-white, and brown/brown-white.
5. Each cable shall be marked sequentially with the footage of the cable. Each cable shall also be marked with the manufacturer of the cable and the type of cable installed or the cable part number.
6. Cable and all connectors and patch panels shall meet or exceed the following electrical and physical requirements:

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<th>DC RESISTANCE (max)</th>
<th>23 AWG</th>
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<td>Ohms/100m @ 20°C</td>
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<tr>
<td>DC RESISTANCE UN_BALANCED (max)</td>
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<td>Individual Pair %</td>
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<th>DELAY SKEW (max)</th>
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<th>NOMINAL VELOCITY OF PROPAGATION (NVP)</th>
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<td>% Speed of light</td>
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<th>PS-ACR DB@100 m (min)</th>
<th>ELFEXT dB (min)</th>
<th>PS-ELFEXT m (min)</th>
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<tr>
<td>500 MHz</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
7. All cables shall be Plenum Rated
8. After installation the CAT-6 cable shall be capable of transmitting the following signals:
   a. Voice.
   b. T-1.
   c. 10BASE-T (IEEE 802.3).
   d. 4/16 MBPS Token Ring (IEEE 802.5).
   e. 25/155 ATM.
   f. 100—VG-AnyLAN.
   g. 100 Mbps TP-PMD (ANSI X3T9.5).
   h. 100 BASE-T (IEEE 802.3).
   i. 1000 BASE-T (IEEE 802.3ab).
9. Ensure that cable passes all CAT-6 tests after installation.
10. CAT-6, 4 pair cabling shall be plenum rated unless specifically noted.
    a. Cat-6 UTP Cables for Data Communications shall be Green in color, Hubbell Cable # C6RPG or equal.
    b. Cat-6 UTP Cables for Voice Communications shall be Yellow in color, Hubbell Cable # C6RPY or equal.
    c. Cat-6 UTP Cables for Security Cameras shall be Purple in color, Hubbell Cable # C6RPP or equal.
    d. Cat-6 UTP Cables for Wireless Access Points shall be Green in color, Hubbell Cable # C6RPG or equal.
    e. Cat-6A STP Cables for Audio/Video shall be Blue in color, Hubbell Cable #C6AFTPSPB or equal.
B. Voice and Data modular jacks shall be CAT-6 rated, 8 position, unkeyed:
   1. Each jack shall be an individually constructed unit and shall snap mount in an industry standard
      keystone opening (.760 inches x .580 inches).
   2. Jack housings shall be high impact 94 V-0 rated thermoplastic.
   4. Modular jack contacts shall accept a minimum of 1000 mating cycles with 5.0 milliohm (maximum)
      increase over initial with the use of an FCC compliant plug.
   5. Modular jack contact wires shall be formed flat for increased surface contact with mated plugs.
   6. Modular jack contacts shall be constructed of beryllium copper for maximum spring force and
      resilience.
   7. Contact plating shall be a minimum of 50 micro inches of hard gold in the contact area over
      50 micro inches of nickel.
   8. Jack termination shall follow the industry standard 110 IDC.
   9. Jacks shall have a designation indicating CAT-6.
   10. Jacks shall utilize a paired punch down sequence. Cable pair twist shall be maintained up to the IDC,
      terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by
      the cable manufacturer.
   11. Jacks shall terminate 22-26 AWG stranded or solid conductors.
   12. Jacks shall terminate insulated conductors with outside diameters up to .050 inches.
   13. Jacks shall be compatible with single conductor, 110 impact termination tools.
   14. Jacks shall include translucent wire retention stuffer cap that holds terminated wires in place and
      allows the conductors to be visually inspected in the IDC housing.
   15. Jacks shall be compatible with EIA/TIA 606A color code labeling.
   16. Jacks shall accept snap on icons for identification or designation of applications.
   17. Jacks shall be marked for T568A and T568B wiring schemes. TIA 568B wiring shall be used in all
      terminations throughout the communications system.
   18. All CAT-6 modular jacks and panels shall meet or exceed the following transmission characteristics:
       a. Jacks shall be designed for 100 Ohm UTP cable termination.
       b. Jacks shall be UL verified for TIA/EIA Category 6 electrical performance.
       c. Jacks shall be UL listed 1863 and CSA certified.
       d. Jacks shall be manufactured by an ISO 9002 registered manufacturer.
   19. CAT-6, 8-pin modular jacks shall be:
       a. Data Jacks shall be Hubbell # HXJ6OR or equal. Orange.
       b. Data Jacks for Voice shall be Hubbell # HXJ6W or equal. White.
       c. Data Jacks for Security Cameras shall be Hubbell # HXJ6OR -Orange.
       d. Data Jacks for Wireless Access Points shall be Hubbell # HXJ6OR -Orange.
e. STP Shielded Data Jacks for Audio and Video connections shall be Hubbell # SJ6A2B.

C. Standard flush mount faceplates shall support all the jacks and connectors required.
1. Faceplates shall be UL listed and CSA certified.
2. Faceplates shall be constructed of high impact thermoplastic.
3. Faceplates shall be 2-3/4 inches wide x 4-1/2 inches high (69.8 mm x 114.3 mm) for single gang, and 4-1/2 inches x 4-1/2 inches (114.3 x 114.3 mm) for double gang.
4. Faceplates shall be available to mount 1, 2, 3, 4, or 6 jacks in a single gang and up to 12 jacks in a double gang configuration.
5. Faceplates shall provide for TIA/EIA 606A compliant station labeling.
6. Faceplates shall have plastic covers over the mounting screws that can be replaced with a clear plastic window over a printable paper insert.
7. Each plate shall be fully configured with modular inserts. There shall be no open spaces in the faceplate.
8. Match the color of the modular inserts to the color of the faceplate. All faceplates and inserts shall be office white unless otherwise noted.
9. Single gang faceplate shall be Hubbell # IMF1OW.
10. Double gang plate shall be Hubbell # IMF2OW.
11. Double Gang, stainless steel, modular faceplates shall be Hubbell # IMS2
12. Each single gang plate has 3 faceplate units (FPU’s) available to install inserts. Double gang plates have 2 sides, each with 3 FPU’s.
13. Equip plates with the following parts as directed on the construction drawings.

<table>
<thead>
<tr>
<th>FPU</th>
<th>ITEM</th>
<th>PART NUMBER</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Blank Jack</td>
<td>SFB10</td>
</tr>
<tr>
<td>.5</td>
<td>Blank</td>
<td>IMB05OW</td>
</tr>
<tr>
<td>1</td>
<td>Blank</td>
<td>IMB1OW</td>
</tr>
<tr>
<td>1.5</td>
<td>Blank</td>
<td>IMB15OW</td>
</tr>
<tr>
<td>1</td>
<td>1 Port Flat</td>
<td>IM1K1OW</td>
</tr>
<tr>
<td>1</td>
<td>2 Port Flat</td>
<td>IM2K1OW</td>
</tr>
<tr>
<td>1.5</td>
<td>1 Port Angled</td>
<td>IM1KA15OW</td>
</tr>
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<td>2 Port Angled</td>
<td>IM2KA15OW</td>
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<tr>
<td>1.5</td>
<td>SC Angled</td>
<td>IM1SCA15OW</td>
</tr>
<tr>
<td>2</td>
<td>Two SC Angled</td>
<td>IM2SCA2OW</td>
</tr>
</tbody>
</table>

D. Some locations will require custom stainless steel plates. These shall be configured with the correct connectors and pass thru’s to support all the data, audio and video.
1. All shall be silk-screened to detail what each connector is for.
2. Submit a product sheet for approval prior to purchase of the plates.

E. In addition to flush faceplates and surface housings, some installations call for integrated furniture outlets, GFI style outlets, and standard 106 style frames. These may be required at some surface raceway location. Field verify prior to ordering.
1. The Contractors shall identify which type of outlet or frame is required at each location throughout the system.
2. Match the particular outlet with the faceplate required.
3. GFI, more commonly referred to as style line outlets, are rectangular and fit in a rectangular plate used for GFI receptacles.
4. Each type of modular furniture has certain requirements for its voice and data modules. The Contractor shall coordinate with the furniture installer and provide the correct faceplate and outlets to match the color and style of the furniture.
5. The 106 style frame fits in a common duplex electrical receptacle faceplate. The frame holds 2 or 4 modular jacks.
6. For all connections that do not have a faceplate with a location for a laser printed paper label, the Contractor shall provide an engraved lamacoid label detailing the location number of each cable.
7. GFI Plates shall be Hubbell # ISF2OW, ISF3OW, ISF4OW or ISF6OW; or equal.
8. 106 style plates shall be: Hubbell # BR106C or Q106) or equal.
9. Style Line plates shall be:
   a. Two-port, Hubbell #ISF2OW.
   b. Three Port, Hubbell #ISF3GY.
   c. Four Port, Hubbell #ISF4W.

F. Provide surface mount boxes for termination of cables as shown on the drawings.
   1. Install a surface mount box at location for termination of the CAT-6 jack.
   2. Single cable surface box shall be Hubbell #ISM1OW.
   3. Multiple cable surface box shall be Hubbell #ISM40W.

G. All cables shall be supported in the ceiling a minimum of every 5 feet. Support can be provided by installing cable inside cable tray or conduit, or by installing J-hooks every 5 feet.
   1. J-hooks shall provide a smooth steel support for cables as they route through the ceiling.
   2. Each hook shall have a galvanized finish.
   3. Steel, UL listed, ultimate static load limit 50 pounds rated to support Category 3 and higher cables, and optical fiber cables.
   4. If required, assemble to manufacturer recommended specialty fasteners, including beam clips and flange clips.
   5. Acceptable products shall be by CADDY, and shall be the CableCat series of J-hooks.
   6. Provide surface mount boxes for termination of cables as shown on the drawings.
   7. No more than 50 voice/data cables in each J-hook. Provide additional hooks as required.

H. Firestopping shall be completed inside and around all conduits after cable installation. Firestop for the area between the cable and the edge of the conduit shall be Nelson No. FSP, CLK or LBS+. Contractor shall install the best firestop for each individual installation.
   1. Firestop shall be installed with regard to local and national building codes.
   2. The firestop shall be a putty like substance that expands under heat and will not allow flame to pass for a designated period of time.
   3. Firestop shall conform to all NEC, NFPA, and UL requirements.
   4. Some wall pass-thru’s are shown on the drawings. The Contractor shall utilize these where possible.
   5. Where the contractor must install cables through a wall where there is no pass-thru already provided, the Contractor shall be responsible for installing a fire-rated pass-thru and fire-stopping the conduit after cable installation.

I. CAT-6 patch panels for mounting in a 19-inch rack shall be Hubbell No. UDX48E or approved equal CommScope, Ortronics, Leviton, or Beldon. See Transmission characteristics above for requirements.
   1. Panels shall be made of black anodized aluminum, in 48 port configurations.
   2. Panels shall be manufactured with a rolled edge at the top and bottom for stiffness.
   3. Panels shall have modular jacks employing staggered array contacts with a flat "hairpin" design made of beryllium copper with a minimum 50 micro inch gold plating on contact surfaces over 50-100 micro inch of nickel compliant with FCC Part 68.
   4. Panels shall have rear cable support bar for strain relief which shall clip to the rear of the patch panel.
   5. Panels shall be marked for the panel, communications room and rack with a large laser-printed label.
   6. Panels shall provide wiring identification and color code and maintain a paired punch down sequence that does not require the overlapping of cable pairs.

J. Shielded patch panels for connection of certain cables as noted on the drawings shall be steel and allow multiple modular jacks to be installed in the jacks.
   1. 24 port blank panels shall be Hubbell #PSJ24S or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine all pathways prior to installation of all cables.
B. Identify locations of all user conduits and backboxes prior to cable installation.

C. The Engineer or the Owner has the right to make adjustments to the location of any outlet to a new location within 7 wall-feet of the original location. If the change is made prior to final cable termination, and prior to any raceway being installed, then the changes shall be a no cost change to the contract.

D. Identify all locations where cable will route through furniture raceway or other nonstandard conduit or raceway installation. Make arrangements to install and terminate all cables in accordance with TIA/EIA 568 standards.

3.2 PREPARATION

A. Locate main path for all cables and install J-hooks where cable tray is not provided.

B. Coordinate with other trades to install a clear, straight path down major corridors for the routing of user cables back to the communications closet.

C. Plan installation of cables along cable ladder of rack system in communications room. All cable shall be neatly routed in groups of no more than 24 cables.

3.3 INSTALLATION

A. CAT-6 cabling shall be installed according to TIA/EIA 568-B standards, including all updates and addenda.
   1. When installing CAT-6 cables, care shall be taken to avoid crimping or bending the cable past the manufacturer’s recommended bend radius.
   2. During installation, the cables shall not be pulled across the ceiling tiles or the structure of the building. This may cause damage to the cable jacket.
   3. Adhere to all pulling tensions and bend radii during installation. Excessive pulling or bending can cause the cable to fail tests after installation. Any cable that does not pass the CAT-6 tests after installation shall be fixed or replaced at the Contractor’s expense.
   4. All cables shall route neatly in the ceiling. Whether they route in cable tray or J-hooks, the cables shall be neat and orderly.
   5. There shall be no more than 50 cables in each J-hook. Provide additional J-hooks as required.
   6. Support all cables at a minimum of every 5 feet.
   7. Provide a short coil of extra cable where the cable enters the vertical conduit. The coil shall consist of no less than 1-1/2 feet.
   8. Provide enough slack in the backbox to fully remove the faceplate and jack and allow work to be done on the cable.
   9. When installing cables in the communications room, all cable shall route neatly through the cable tray and cable ladder.
   10. When transitioning from the ceiling area to the cable ladder of the rack system, all cable shall route through conduits or be attached to vertical section of cable ladder. The Contractor shall provide the conduits shown and any additional conduits or cable ladder required to neatly transition cables from the ceiling to the rack.
   11. Bundle cables in groups of no more than 24 cables as it routes along the cable ladder.
   12. Cables shall route down each side of a rack for termination. Split each panel into 2 sides. The first 12 positions on a panel are on the left, and positions 13 through 24 are on the right. Route the cables for panel positions 1 through 12 down the left cable ladder and route the cables for positions 13 through 24 down the right cable ladder.
   13. Each patch panel shall utilize a rear organizer for holding the cables as they route to the punchdown field.
   14. Cables shall be bundled in groups of 4 as they route through the rear cable organizer.
   15. When terminating cables, ensure that the smallest amount of jacket is removed from the final termination point of the cables.
   16. Pair twists shall be maintained up to the IDC jack for all the cables.
   17. When terminating cables on the back of patch panels, or on modular jacks, use only single point, 110 style punchdown tools. Multiple pair punchdown tools are not permitted for terminating individual 4 pair cables.
19. Provide a service loop of the cables on the vertical cable ladder. The loop shall extend no less than 1 foot below the termination point on the patch panel. Route the cables 1 foot below the patch panel, and then back up to the panel. This will provide room for future moves and additions to the rack.

20. Each cable shall have a self adhesive, self laminating, laser printed label at each end. The label shall show the location identifier of that cable. Labels shall be installed no more than 4 inches from the termination point of the cable.

B. CAT-6 data/voice jacks shall be installed at the user end of each CAT-6 cable installed in the system.
   1. Jacks shall be installed to provide minimal signal impairment by preserving wire pair twists as close as possible to the point of mechanical termination.
   2. Jacks shall be installed according to manufacturer’s instructions and properly mounted in plates, frames, housings, or other appropriate mounting devices.
   3. Jacks shall be installed such that cables terminated to the jacks maintain minimum bend radius of at least 4 times the cable diameter into the workstation outlet. Cables shall be terminated on jacks such that there is no tension on the conductors in the termination contacts.
   4. All voice/data jacks shall be office white unless noted otherwise.

C. Faceplates shall be mounted straight and level with the floor and walls of the building.
   1. Jacks and/or connectors shall be terminated to the appropriate cable and inserted in the correct orientation into the faceplate prior to the mounting of the faceplate.
   2. Jacks shall be inserted into the faceplate left to right, then top to bottom. 2 gang plates shall be labeled left to right, then top to bottom for each gang.
   3. Cable slack shall be stored behind the faceplate in such a way that allows the minimum bend radius of the cables to be maintained as per the following:
      4. Fiber Optic Cable, a minimum of 2 feet (1 m) slack, with a minimum bend radius of 1.18 inches (30 mm). UTP cable, a minimum of 1 foot of slack, with a minimum bend radius of 4 times the cable diameter.
   5. Care shall be taken when mounting the faceplate to avoid crimping or kinking the cables.
   6. Faceplates shall be securely mounted to a surface mounted housing, a recessed box, or box eliminator bracket.
   7. Each faceplate shall be labeled with laser printed paper inserted behind the clear plastic label strips.
   8. The label shall show the location identifier of the faceplate and the letter designation for each cable. The label shall be as large a font as possible and easily readable.
   9. Each faceplate comes with a label strip at the top and the bottom.

D. Surface Mount boxes
   1. Jacks and/or connectors shall be terminated to the appropriate cable and inserted in the correct orientation into the surface mount box.
   2. When the surface mount jack is mounted above the ceiling the cable shall be coiled and the cable and surface mount box shall be kept off of the ceiling grid.
   3. Attach the coil to the building structure with a plenum rated tie-wrap.
   4. Label each surface mount box for the cable number. Also install a wrap-around label on each cable.
   5. When attaching a surface mount box to a piece of furniture or to a power pole the contractor shall drill a hole in the furniture/pole that is larger than the hole on the back of the surface box.
   6. Screw the surface box to the furniture or to the pole. Adhesive only solutions are not adequate.

E. Proper support of cables is of paramount importance when installing a cable infrastructure. All cables not in conduit or cable tray shall be supported via J-hooks a minimum of every 5 feet.
   1. Routes of cables shall be parallel or perpendicular to the walls of the building.
   2. Install the J-hooks to minimize changes in the level of the cables as they route through the J-hooks.
   3. Do not install more than 50 cables in any 1 J-hook. Provide additional hooks where more than 50 cables route along a main route.
   4. All communications shall route as high in the ceiling as possible while still being accessible and staying away from other utilities.
   5. When installing the cable through the J-hooks, they shall all have relatively the same droop between hooks. All cables shall be installed neatly and squarely.
   6. Secure the J-hooks to the building structure with beam clamps and threaded rod as required to support the cables.
7. J-hooks shall never be attached to drop ceiling support wires. Cables shall never be supported by drop ceiling wires.

F. Firestopping is required at all riser conduits and all pass thru's.
1. Each cable tray penetration of a wall shall be firestopped after cable installation. Use pillow type firestop to allow additional cables to be installed in the future.
2. Where riser conduits pass through floors, the area between the concrete and the conduit shall be firestopped. This shall be completed with a putty or liquid firestop product. Fill in the space with mineral wool, and then install the firestop on top. All firestop shall be of sufficient thickness to secure the rating required by code.
3. After final cable installation, install a putty firestop around all cables where they enter and exit conduit pass thru's and conduit risers.
4. All firestop shall be installed to provide the fire rating as described by local fire code.
5. It shall be the responsibility of the Contractor to verify that all conduits, walls, and raceways required to be firestopped have been firestopped.

G. CAT-6 patch panels shall be installed between patch cord organizers in the racks.
1. Panels shall be installed to provide minimal signal impairment by preserving wire pair twists as closely as possible to the point of mechanical termination. The amount of untwisting in a pair as a result of termination to the patch panel shall be no greater than a 1/2 inch (13 mm).
2. Panels shall be installed according to manufacturer’s instructions and properly mounted to a rack, cabinet, bracket, or other appropriate mounting device.
3. Panels shall be installed such that cables terminated to the panel can maintain minimum bend radius of at least 4 times the cable diameter into the IDC contacts. Cables shall be terminated on the panels such that there is no tension on the conductors in the termination contacts.
4. Each patch panel shall have 2 rear cable organizers for routing cable from the vertical cable ladder to the patch panel. 1 organizer for each row of 24 cables.
5. The label for each outlet on the panel shall be the same as the wraparound label on each end of the cable.
6. Each label shall line up directly below or above the outlet on the panel. Misaligned labels will not be permitted.

H. Shelves shall be installed where equipment will need to be supported and the equipment is not directly rack mountable.
1. Contractor shall supply shelves that correspond with the weight of the equipment being supported by the shelf.
2. Shelf shall be able to support 50 pounds or more.
3. Blank panels shall be provided for locations where equipment or panels must be mounted flat on the rack, but are not directly rack mountable. See drawings for details.

END OF SECTION 27 16 00
SECTION 27 72 00 – SUBMITTALS

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 SECTION INCLUDES

A. This section provides the Contractor with requirements in regard to Product Data, Shop Drawings and Product Samples collectively referred to as “Submittals”.

B. The requirements of this section deal only with those submittals that are required to be provided by the chosen contractor prior to beginning the work. No submittals in this section are required to be provided with the Bid Response.

C. The requirements contained herein should be considered bound and apply to all specification sections per this contract.

1.3 SUBMITTALS

A. The contractor shall provide material submittals to the Construction Manager or directly to the engineer, whichever is managing the project.

B. Prior to beginning work, the chosen Contractor shall provide 4 sets of material submittals. All paper submittals shall be bound in a 3-ring binder. The binder shall be clearly marked with the project name and number, and additionally marked as “submittals.”

C. Send an Excel spreadsheet in .xls format to the designer for their use in reviewing the submittals.

D. PDF documents for submittals are allowed.

PART 2 - PRODUCTS

2.1 PRODUCT DATA SHEETS

A. Product data sheets shall consist of the manufacturers detailed specification sheets or “cut-sheets” for each product that is to be installed by the contractor or any subcontractors.

B. Product data sheets shall minimally include, but shall not be limited to:
   1. Part Number.
   2. Manufacturer.
   3. Description of the product.
   4. Physical dimensions and characteristics of the product.
   5. Picture or manufacturers drawing of the item, where applicable.
   6. Electrical characteristics of the product including heat-load for active electronics.
   7. Optical characteristics of the product for Fiber-Optic equipment and cable.

C. Provide product data sheets for all equipment and cabling that is to be installed by the contractor.
2.2 SHOP DRAWINGS

A. Shop Drawings shall consist of detailed drawings showing actual connectivity and cable types for the systems noted below:
   1. Data Network.
   2. DSL.

B. Shop drawings shall also be provided for systems that the contractor intends to connect differently than what is shown on the contract drawings or where no connectivity is shown.

2.3 PRODUCT SAMPLES

A. Product Samples shall consist of a sample of the actual product that is to be installed.

B. Samples shall be tagged with the part number and specification section to which it pertains.

C. Product Samples shall be provided for the following: None at this time.

PART 3 - EXECUTION

3.1 DOCUMENTS

A. The Contractor shall provide all submittals to the Construction Manager or the Engineer and obtain owner’s approval prior to beginning installation.

B. The Contractor shall provide 4 sets of Product Data Sheets.
   1. All Product Data sheets shall be bound in a 3-ring binder. The binder shall be clearly marked with the project name and number, and additionally marked as “Product Data Sheets.”
   2. The data sheets in the binder shall be segmented to match the specification section and page number they pertain.
   3. The Contractor shall highlight the actual part number on the sheet of the component that they are submitting. If no part number is highlighted or marked with an arrow, then the entire submittal package will be rejected and sent back for re-submission.
   4. Contractor shall submit a spreadsheet with their data sheets that details the manufacturer, part number and common name of the products that they are submitting.

C. The Contractor shall provide 4 sets of Shop Drawings.
   1. Shop drawings shall be marked for the specification section of the bid documents to which they pertain.
   2. All shop drawings that are required to be drawn on the building background shall be provided on full-size drawings the same scale as those in the bid documents.
   3. All lines on the shop drawings shall be highlighted or completed in ink that is not the same color as that provided in the bid documents.
   4. The contractor shall provide a drawing legend detailing all symbols used in creation of the shop drawings.

D. The Contractor shall provide one of each product sample required to be submitted.
   1. Provide a cutsheet with each product sample detailing the specifics of the product and what it is proposed to be used for.

3.2 SUBMITTAL REQUIREMENTS

A. Submittals shall be provided for approval prior to installation of the work.

B. Any equipment installed that does not have an approved submittal associated with it can and will be removed from the project and replaced with other equipment as defined by the Engineer. All replacement costs shall be the responsibility of the Contractor.
C. It shall be the responsibility of the Contractor to provide the submittals for review in sufficient time so as to not delay the installation. Work with the Construction manager on the schedule.

END OF SECTION 27 72 00
SECTION 27 76 00 – LABELING

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 SECTION INCLUDES
A. This section provides direction on labeling of cables and devices.

PART 2 - PRODUCTS

2.1 LABELING PRODUCTS INTERIOR
A. Laser printed, self-adhesive wrap around labels for CAT- 6, Coax and audio / video cabling user cables shall be Brady LAT-18-361 or equivalent.
   1. Label shall be 1.00 inch width x 1.33 inch high.
   2. Labels shall come on a sheet with 7 labels per row with a white and transparent matte finish.
   3. Sheet size shall be 8-1/2 inch x 11 inch.
   4. Printable area shall be a minimum of 1.00 inch width x 0.50 inch high.
   5. All labels shall be printed through a laser printer using labeling software.
   6. The Contractor shall submit a proposal for the labeling scheme for all audio and video wiring. The Engineer shall approve of the scheme prior to all labeling.

B. Laser printed, self-adhesive wrap around labels for fiber cables shall be Brady LAT-19-361 or equivalent.
   1. Label shall be 1.00 inch wide x 3.167 inch high.
   2. Labels shall come on a sheet with 7 labels per row with a white and transparent matte finish.
   3. Sheet size shall be 8-1/2 inch x 11 inch.
   4. Printable area shall be 1.00 inch wide x 0.97 inch high.
   5. All labels shall be printed through a laser printer using labeling software.

C. Interior exposed fiber cable and fiber cable inside inner duct shall be labeled every 100 feet, label shall be Panduit No. PST-FO.
   1. Label shall be covered with a clear laminate to protect the legend of the label.
   2. Attachments for tie wraps shall be available on the label to attach it to the cable or inner duct.

D. Laser printed, paper labels shall be used to label user faceplates and patch panels.
   1. Individual paper labels shall be installed behind the clear plastic strips of all user faceplates and surface mount housings.
   2. The labels shall show the location identifier number and letter of each individual cable. See Specification Section 17160 for details.
   3. Paper insert with laser printed identifiers shall be provided for each outlet on a patch panel.
   4. Patch panel labels shall be printed in a strip and inserted into plastic designation strips that are 17 inches long. Designation strips shall be self-adhesive, 3/8 inch high and shall be Hol-Dex from Aigner Index.
   5. Paper inserts shall fit inside the designation strips.

E. Engraved, lamacoid labels shall be supplied for locations where paper inserts are not available.
   1. All engraved labels shall be self-adhesive for attachment to various products.
   2. Engraved labels shall be installed at locations including but not limited to:
      a. Racks and cabinets.
      b. User cable locations where paper inserts are not available.
      c. Ground bars.
   3. Size the phenolic labels for their individual uses. Provide a sample to the Engineer for approval prior to ordering or installation.
PART 3 - EXECUTION

3.1 PREPARATION

A. Terminate all cables in proper color code sequence.

B. Clean any surfaces where an adhesive label is to be installed.

C. Prior to beginning the work, the contractor shall submit to the engineer a plan for labeling all the cables. This shall take into account to what components each cable is connected.

3.2 EXECUTION

A. Cable labels for CAT-6 user cables from the faceplate to the patch panel shall be installed within 4 inches of the end of the cable sheath.

1. The location identifier is made up of 3 fields, and a sample might look like this:

   A-X-YY

   Label is shown for reference only, Refer to drawing for labeling scheme.

   This system of identification provides the Owner with an easy way to keep track of cables, and where they are located or terminated.

2. The cable label shall be similar to the label below:

   A-X-YY
   A-X-YY
   A-X-YY

3. Provide a sample label to the Engineer for approval prior to installation of all labels.

4. Labels shall be installed at each end of each cable. Shall be within 4" of the termination.

B. Fiber Panel labeling shall be done for the front of each fiber optic patch panel.

1. The figure below demonstrates the layout of the fiber panel label. Each label shall be customized for each individual panel. The figure below is for the 72 port panel.

2. Contact the Engineer with questions on the correct labeling prior to installation.

<table>
<thead>
<tr>
<th>12 SM TO HIGH SCHOOL</th>
<th>12 MM TO COMM RM “B”</th>
<th>12 SM TO COMM RM “C”</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 03 05 07 09 11</td>
<td>01 03 05 07 09 11</td>
<td>01 03 05 07 09 11</td>
</tr>
<tr>
<td>02 04 06 08 10 12</td>
<td>02 04 06 08 10 12</td>
<td>02 04 06 08 10 12</td>
</tr>
</tbody>
</table>

Figure A – Label for 36 Port Fiber Patch Panel

C. Paper inserts shall be supplied for all faceplates and patch panels labels.

1. Paper inserts for the faceplate shall detail the exact location identifier for each cable.

2. They shall fully cover the background of the insert space on the faceplate, but all numbers and letters of the identifier shall be visible after installation of the plastic cover plate.
3. The paper insert for a standard faceplate will look like this:

   Top Label Strip

   Bottom Label Strip

4. Provide a sample label to the Engineer for approval prior to installation of all labels.

D. Camera cable shall be labeled.
   1. For CAT-6 cables the contractor shall label as detailed on the drawing
   2. Each cable shall have a unique identifier and shall be labeled with a wraparound label at each end
      with an adhesive, self-laminating label showing that unique identifier.
   3. Cable labels for camera cables shall be installed within 4 inches of the end of the cable sheath.

   A-X-YY-DDD

   Label is shown for reference only, Refer to drawing for labeling scheme.

   a. The cable label shall be similar to the label below:

   


   b. Provide a sample label to the Engineer for approval prior to installation of all labels.

   A = Communications room
   BB = Patch panel where cable terminates
   CC = Port on patch panel where cable terminates
   DDD = Camera number

E. All labels shall be installed to more easily identify the cables and ports on all panels. If there are any
   questions regarding labeling, contact the Engineer prior to installation.

F. Engraved lamacoid labels shall be provided and installed whenever there is no location for paper inserts on
   faceplates, power poles, poke thru’s, floor boxes, modular furniture and surface raceway.
   1. Engraved lamacoid labels shall provide the same labeling as the paper inserts, but they shall be self-
      adhesive.
   2. These labels shall be adhered to the location closest to the modular jack.
   3. Individual letters shall be provided for each cable. An overall location identifier can be provided for all
      the cables at that faceplate or floor box.
   4. Engraved labels for rack shall be at least 1-1/2 inch high with letters 1 inch high.
   5. These labels shall be affixed to the top and front of each rack or cabinet. Verify that the label will fit the
      rack or cabinet prior to purchasing.

G. All labels shall be installed to more easily identify the cables and ports on all panels. If there are any
   questions regarding labeling, contact the Engineer prior to installation.

END OF SECTION 27 76 00
SECTION 27 77 00 – TESTING

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 WORK INCLUDED

A. This section provides direction on testing of copper cable, labeling, and administration of the drawings and information.

1.3 SYSTEM DESCRIPTION

A. All cables installed shall be tested and labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Approved vendors for cable testers are: Fluke; or equal.

2.2 TESTING PRODUCTS

A. Category 6 cable shall be tested.
   1. Cable tester shall support Cat 6 channel and permanent link certification.
   2. Tester shall provide accuracy beyond TIA level III requirements traceable to laboratory reference standards.
   3. Through add on fiber optic probes, the tester shall be able to test multimode and single mode fiber cable.
   4. Test results shall be able to be stored on internal or removable compact flash memory cards.
   5. Tester shall have optional talk set for discussions over the cable being tested.
   6. Tester shall support a frequency range of 1-500 MHz with accuracy to the current proposed TIA Level III.
   7. Tester shall support the following tests:
      a. Near end crosstalk (NEXT).
      b. Attenuation.
      c. Equal level far end crosstalk (ELFEXT).
      d. Return loss.
      e. Ambient noise.
      f. Wire map shall identify miswires, shorts, opens, reversals, and split pairs.
      g. Shall measure cable length and distance to faults (if any).
      h. Propagation delay.
      i. Loop resistance.
   8. Tester shall support the following test standards:
      a. TIA Cat 6 and ISO Class E.
      b. TIA Cat 5.
      c. TIA TSB-95.
      d. TIA Cat 3, 4 and 5 per TIA TSB-67.
      e. UTP, STP, SCTP coaxial and twinax cabling.
      f. IEEE: all Ethernet 802.3UTP and fiber PMD interfaces including 10GBASE-T; other 802.x PMD interfaces including token ring and demand priority.
      g. ATM: All UTP and fiber PMD interfaces.
   9. Tester shall have all required probes and accessories required to perform CAT-6 tests and “Network Tests.”
   10. Tester shall have been recently calibrated (within 4 months), and shall be utilizing the latest software.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Testing shall be completed after fiber is installed inside the fiber patch panel and the fiber panel has been put together.

B. All cables and panels where cables terminate shall be labeled with the cable label or name of each individual cable. Identify how each cable and panel will be labeled.

3.2 PREPARATION

A. Terminate all cables in proper color code sequence

B. Clean any surfaces where an adhesive label is to be installed.

3.3 CAT-6 TESTING

A. Cable tests for CAT 6 cables shall be provided for each user CAT-6 cable.
   1. Prior to beginning the testing, the Contractor shall provide the Engineer with a notice that testing will begin. Written notice shall be given at least 3 business days prior to testing beginning.
   2. Tester shall be calibrated each day with manufacturer provided calibration cable.
   3. Tests shall be saved under each cables unique location identifier.
   4. Contractor shall provide the correct cables and probes specifically for the cable and modular jacks that are being tested.
   5. During the test the tester shall be set to check all “Network Tests.”
   6. Test results shall be provided in hard copy and soft copy. Along with the soft copy, provide a copy of the software required to read the test results.
   7. Contractor shall supply 2 copies of the paper results and 2 copies of the file results.
   8. Provide all paper results in 3-ring binders. Binders shall have a cover that shows the job name, job number, building and closet where the cables were tested, and the range in the location identifiers of the cables tests provided.
   9. Tester shall be set to match the cable being tested.
   10. Contractor is responsible for ensuring that all cables pass the tests. Any cable found not to pass shall be removed and replaced at the Contractor’s expense.

END OF SECTION 27 77 00
SECTION 27 77 50 – TRAINING

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 SECTION INCLUDES

A. This section includes directions for the Contractor regarding system cutover and training.

1.3 SYSTEM DESCRIPTION

A. The Contractor shall provide training on all the installed systems.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 GENERAL TRAINING REQUIREMENTS

A. The Contractor shall provide training on all systems installed or upgraded as part of the contract.
   1. The Contractor shall involve the personnel from the Owner’s office in the implementation and configuration of the network systems.
   2. Prior to the cutover of the system, the Contractor shall work with the Owner on the training that will be provided. The Owner and the Contractor shall schedule the training at a time beneficial to both.
   3. Each system is to have training provided as part of the installation.
   4. Each training session shall include.
      a. This training will give an overview of the capabilities of each system, and the methods to be employed in utilizing the system.
      b. The Contractor shall provide a syllabus detailing what will be discussed at the training, and notes for the Owner to refer to during the life of the system. The notes shall list directions for general use of the system and possible fixes to general issues that could occur.
      c. Training shall include as-built diagrams of the connectivity, a walk-thru of the system, a demonstration of actual user interface with the system, and directions on its general use.
      d. This training is only meant to give an overview of each system. In depth training shall be provided for an in-depth analysis of certain systems as described below.
   5. For all training, the Contractor shall pay all expenses.

B. Create cheat sheets for all systems that the users can keep after the training.
   1. Cheat sheet shall include details on how to use the system.
   2. A copy of the cheat sheet shall be laminated and installed at the system location.
   3. For individual training the contractor shall provide a cheat sheet for each person being trained.

END OF SECTION 27 77 50
SECTION 27 77 80 – WARRANTY

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 SECTION INCLUDES
   A. This section includes directions for the Contractor regarding system sign off and warranty.

1.3 SYSTEM DESCRIPTION
   A. The project is not complete until all paperwork has been provided.
   B. The Contractor shall warranty his work and all the products installed for a minimum of 1 year from day of Final completion.

1.4 COORDINATION
   A. Coordinate as-built drawings and records with the Engineer and Owner.

PART 2 - PRODUCTS

2.1 MATERIALS
   A. The Contractor shall provide the following to the Engineer prior to the issuance of the Notice of Final Completion.
      1. Manuals and pamphlets on all electronic equipment.
      2. All spare parts and coverplates for all components of the network.
      3. Red lined set of as-built drawings for the entire project.
      4. Updated hard copy and soft copy of the cable test spreadsheet.
      5. Manufacturer warranty cards for all components.
      6. Hard copy and soft copy of all electronic components broken out per closet, detailing their manufacturer, and their serial number.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Contractor shall fully examine all components of the system to make sure that all manuals and paperwork are included in the final submittal.

3.2 PREPARATION
   A. All binders for test results shall be neat and clearly labeled with listing of the tests included.
   B. Prepare a list of the items in each closet or between closets that are not completed and a date when they will be completed.

3.3 PROJECT DELIVERABLES
   A. All manuals and pamphlets shall be separated by equipment type.
B. All spare parts shall be provided in a box. The Contractor shall detail which component each spare part is for. Spare parts may include, but not limited to: blank covers for electronics, supports and mounting hardware.

C. The contractor shall provide two sets of as-built prints.
   1. The first set shall be a clean set of the latest drawings with red lines marked for all field changes or bulletins.
   2. The second set shall be a clean set of the latest drawings that have been updated with the information. These drawings shall be generated from an AutoCAD file that is provided by the engineer. The drawing shall include:
      3. Changes to be reflected on the drawings for Cabling Systems shall include:
         a. Route of exterior conduits and exterior cabling
         b. Rack/cabinet locations.
         c. Faceplate locations
         d. Rack layout of all components in each rack.
         e. Changes to the schematic connectivity of any system shown on the drawings.
         f. Cable numbering for each faceplate. Add this to the updated drawing and the AutoCAD file

D. Test results shall be supplied and submitted. Submit in hard and soft copy for all cable tests. Include software to read the test results

E. The manufacturer of all electronics provides a warranty on their product. The extent of that warranty is spelled out on cards provided in the box for each piece of equipment. These cards or pamphlets shall be provided to the Owner.

3.4 GENERAL WARRANTY

A. The Contractor shall warranty the installation and all the parts contained therein for a period of not less than 1 year after receipt of a completely signed copy of the Notice of Final Completion.

3.5 EXTENDED CABLING WARRANTY

A. The Contractor shall provide to the Owner a “Link Warranty” on all the components of the voice/data cabling system. This includes all components from the faceplate, through the jacks, cable, and back to the patch panels, not including patch cords.

B. Cable shall be installed that is covered as part of the complete warranty on the data cabling system. Cable that cannot be covered under the warranty shall not be installed.

C. The warranty shall be provided through the manufacturer of the faceplate, jacks, and patch panels. All components shall be by the same manufacturer.

D. The warranty shall guarantee that if any part or piece of the “Link” is found to be defective for a period of no less than 15 years, then that part or piece shall be replaced or fixed at no cost to the Owner.

E. The Contractor shall be responsible for installing the system in such a manner that the manufacturer will provide this warranty to the Owner.

F. The Contractor is responsible for compiling and submitting all the paperwork required to receive the warranty. This includes gathering all the information, completing any required forms, and submitting these forms and any other records to the manufacturer as required.

G. It shall be the Contractor’s responsibility to receive the approved warranty notification from the manufacturer and provide that and all the associated paperwork to the Owner.

H. The installation shall not be considered complete until the Owner has received notification, from the manufacturer, that the entire cabling system is covered by their warranty.

END OF SECTION 27 77 80
SECTION 28 31 00 – FIRE DETECTION AND ALARM

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 furnishing and installation of a complete and functional building fire detection and alarm system.

B. Division of Work:
   1. In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the work to be performed by specific trades. The following are suggestions as to how the Work may be divided. This is not a complete list of all the work:
      a. Electrical Subcontractor:  
         1) Coordinate equipment.  
         2) Install and wire all system components.  
         3) Wire and install all duct smoke detectors. Coordinate location and control requirements with Temperature Control Subcontractor.
      b. Fire Alarm System Supplier: Test completed system.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of the Section shall comply with the following:
   1. NFPA Standards:
      c. NFPA 90A - Air Conditioning Systems.
      e. NFPA 13 - Installation of Sprinkler Systems.
      f. NFPA 17 - Dry Chemical Extinguishing Systems.
   2. UL Standards
      a. UL 864 - Control Units for Fire Protective Signaling Systems.
      b. UL 268 - Smoke Detectors for Fire Protective Signaling Systems.
      c. UL 268A - Smoke Detectors for Duct Applications.
      e. UL 464 - Audible Signaling Appliances.
      f. UL 346 - Waterflow Indicators for Fire Protective Signaling Systems.
      g. UL 1971 - Signaling Devices for the Hearing-Impaired.
      h. UL 1481 - Power Supplies for Fire Protective Signaling Systems.
      i. UL 1635 - Digital Alarm Communicator System Units.
   4. Federal Codes and Regulations.
   5. Americans with Disabilities Act (ADA).
      a. ISO-9000.
      b. ISO-9001.

1.4 SYSTEM DESCRIPTION

A. Provide and install a new fire detection and alarm system with Remote LCD Annunciator and fire alarm system devices as indicated on Drawings and this specification.
1.5 DESIGN AND PERFORMANCE REQUIREMENTS

A. System shall be programmed to provide early detection of fire, to notify building occupants, notify Wayne State Campus Safety, override HVAC operation, and activate auxiliary systems to inhibit the spread of smoke and fire and to facilitate the safe evacuation of building occupants.

1.6 GENERAL

A. Upon the activation of any area smoke detector, duct type smoke detector, heat detector, manual pull station, sprinkler workflow, the following functions shall automatically occur:
   1. The internal audible device shall sound at the control panel or command center.
   2. The LCD display shall indicate all applicable information associated with the alarm condition including zone, device type, device location, and time/date.
   3. All remote or local annunciator LCD/LEDs associated with the alarm zone shall be illuminated.
   4. Activate visual strobes and audible appliances on general alarm evacuation.
   5. The visual strobe shall continue to flash until the system has been reset. The visual strobe shall not stop operating when the “Alarm Silence” is pressed.
   6. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.
   7. Transmit signal to the central station with point identification.
   8. Appropriate HVAC equipment shall be turned off until system is reset.
   9. All stairwell/exit doors shall unlock throughout the building.

1.7 DUCT TYPE SMOKE DETECTOR ALARM

A. Upon alarm activation of any duct type smoke detector the following functions shall automatically occur:
   1. The internal audible device shall sound at the control panel or command center.
   2. The LCD display shall indicate all applicable information associated with the alarm condition including zone, device type, device location, and time/date.
   3. All remote or local annunciator LCD/LEDs associated with the alarm zone shall be illuminated.
   4. Activate visual strobes and audible appliances on general alarm evacuation.
   5. The visual strobe shall continue to flash until the system has been reset. The visual strobe shall not stop operating when the “Alarm Silence” is pressed.
   6. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.
   7. Transmit signal Wayne State Campus Safety with point identification.
   8. Appropriate HVAC equipment shall be turned off until system is reset.
   9. All stairwell/exit doors shall unlock throughout the building.

1.8 SUBMITTALS

A. Shop Drawings: For all system components.
   1. Data sheet indicating model number, performance specifications and dimensional data, color and finish.
   2. Details of construction and installation.
   3. Name of manufacturer.
   4. Full system schematic.
   5. Wiring details.
   6. Point-to-point wiring diagram showing all equipment.
   7. Battery calculations.
   8. Floor plan indicating fire alarm system devices only.
   9. Dimension plan indicating all items located inside fire alarm control panel. Plan should indicate future space.
   10. Indicate all features indicated in this specification which are not included in the manufacturer’s equipment. Label these items as “Exceptions to the Specifications”.

B. Layout drawings (plans) identifying all fire detection and alarm system devices. Plans shall be to scale and indicate mounting height for each device.
1.9 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed submittals.
   3. NICET Level 2 certified.

B. Manufacturer:
   1. At least 5 years experience with approved systems.
   2. Having authorized service facility within 60 miles of Site.

C. Components: All components shall be UL listed for intended use.

D. Manufacturer’s Services:
   1. Manufacturer’s Certificate:
      a. Submit for installed system.
      b. Required Assurances:
         1) Confirmation of final inspection.
         2) Installation conforms to Specifications and Manufacturer’s requirements.
   2. Provide Owner training program.

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer’s directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, watertight wrapping.

D. Reject damaged, deteriorated, or contaminated materials and immediately remove from the Site. Replace rejected material with new materials at no additional cost to Owner.

1.11 WARRANTY

A. The Contractor shall warranty all materials, installation and workmanship for 1 year from date of acceptance, unless otherwise specified.

B. A copy of the Manufacturer’s warranty shall be provided with close-out documentation and included with the operation and installation manuals.

C. The System Supplier shall maintain a service organization with adequate spare parts stock within 60 miles of the installation.

D. Any defects that render the system inoperative shall be repaired within 24 hours of the owner notifying the contractor.

1.12 CLOSE OUT

A. Close out submittals shall include:
   1. Project specific operating manuals covering the installed fire detection and alarm system.
   2. Manufacturer’s data sheets and installation manuals/instructions for all equipment supplied.
   3. Owner’s instruction and operation manual.
   4. Record drawings consisting of: a scaled plan of each building showing the placement of each individual item of the fire detection and alarm system as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.
   5. All drawings must reflect point to point wiring.
6. All drawings shall be provided in standard .DXF format. A vellum plot of each sheet shall also be provided.
7. The application program listing for the system as installed at the time of acceptance by the building owner and/or local AHJ (disk, hard copy printout, and all required passwords).
8. Provide the name, address, and telephone of the authorized factory representative.
9. A filled out Record of Completion similar to NFPA 72, 1999 edition figure 1-6.2.1.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Provide products manufactured by one of the following Manufacturers:
   1. Siemens Energy & Automation, Inc.
   2. Simplex.
   4. No alternates will be acceptable.

2.2 CONTROL PANEL

A. The control panel(s) shall be a multi-processor based networked system designed specifically for fire, one-way and two-way emergency audio communications, smoke control.

B. The control panel shall include all required hardware, software and site specific system programming to provide a complete and operational system.

C. The control panel shall include the following circuits:
   1. Class B initiating device circuits.
   2. Class B signaling line circuits.
   3. Class B notification appliance circuits.

D. The control panel(s) operational priority shall assure that life safety takes precedence among the activities coordinated by the control panel.

E. The control panel(s) shall be semi-recessed surface mounted.

F. The control panel(s) shall be beige.

G. The control panel shall include the following capacities:
   1. Support up to 2,500 analog/addressable points.
   2. Support network connections up to 63 other control panels and annunciators.
   3. Support multiple digital dialers and modems
   4. Support multiple communication ports and protocols
   5. Support up to 1,740 chronological events.
   6. The control panel shall include the following features:
       a. Ability to download all network applications and firmware from the configuration computer from the configuration computer from a single location on the system.
       b. Provide electronic addressing of analog/addressable devices.
       c. Provide an operator interface control/display that shall annunciate, command and control system functions.
       d. Provide an internal audible signal with different programmable patterns to distinguish between alarm, supervisory, trouble and monitor conditions.
       e. Provide a discreet system control switch provided for reset, alarm silence, panel silence, drill switch, previous message switch, next message switch, and details switch.
       f. Provide system reports that provide detailed description of the status of system parameters for corrective action or for preventative maintenance programs. Reports shall be displayed by the operator interface or capable of being printed on a printer.
       g. Provide an authorized operator with the ability to operate or modify system functions like system time, date, passwords, holiday dates, restart the system and clear control panel event history file.
7. The control panel shall contain a standby power supply that automatically supplies electrical energy to the system upon primary power supply failure. The system shall include a charging circuit to automatically maintain the electrical charge of the battery.

8. Operator's Interface/Display:
   a. The system shall allow network functions to be configured to apply to any combination of (panels) in the network
   b. Each control panel(s) (network node) shall be capable of supporting a printer. All system control panel printer ports shall be configurable to output any combination of alarm, supervisory, trouble, monitor, or service group event messages.
   c. Each control panel(s) shall be capable of supporting a LCD display. The display on each panel shall be configurable to display the status of any and all combinations of all alarm, supervisory, trouble, monitor, or service group event messages.
   d. From each LCD display on the system shall be capable of being programmed for control functions of any node or the entire network. The LCD display shall reside on the network as a node and continue to operate with any fault on the network. An LCD shall be capable of being programmed to only be operational when a node is in stand alone mode, with a network fault.
   e. The system program shall have a minimum of 100 system definable service groups definable within the program to allow facilitate the testing of installed system based on the physical layout of the system. Service groups that disable the wiring of circuits serving multiple floors or fire zones shall not be considered as equal.
   f. The operator display shall clearly identify unacknowledged and acknowledged alarm, supervisory, trouble, and monitor status messages.
   g. The system shall provide the ability to download data from the analog/addressable detectors to a PC while the system is on-line and operational in the protected premises. The downloaded data may then be analyzed in a diagnostic program supplied by the system manufacturer.
   h. A standby power supply shall automatically supply electrical energy to the system upon primary power supply failure.

9. Annunciation:
   a. The system shall be designed and equipped to receive, monitor, and annunciate signals from devices and circuits installed throughout the building.
   b. Standard LED annunciators may be combined in common enclosures provided that the groups of LED's comprising each of the required annunciators are separated from one another (Detection, Supervisory, Status, and Status) and clearly labeled.
   c. Manufacturers' standard control switches shall be acceptable if they provide the required operation, including performance, supervision, and position indication. If the manufacturers' standard switches do not comply with these requirements, fabrication of custom manual controls acceptable to the Owner is required.
   d. Receipt of alarm, trouble, and supervisory signals shall activate integral audible devices at the control panel(s) and at each remote annunciation device. The integral audible devices shall produce a sound output upon activation of not less than 85 dBA at 10 feet.
   e. The annunciator shall contain the following system status indicators:
      1) 168 character backlit Liquid Crystal Display
      2) System Normal Indicator
      3) System Common Alarm Indicator
      4) System Common Trouble Indicator
      5) System Common Supervisory Indicator
      6) System Ground Fault Indicator
      7) System Common Security Indicator
      8) System Disabled Point(s) Indicator
      9) System Reset Switch with Indicator
     10) System Alarm Silence Switch with Indicator
     11) System Trouble Silence Switch with Indicator
     12) System Message Queue Scroll Switches.
     13) 10-Digit Keypad to Enable/Disable System and Functions.
   f. The LED annunciator rows shall contain the following format:
      1) Provide one row of red (alarm) and yellow (trouble) LED's. LED's in each row shall be arranged in columns, one column per type of alarm initiating device, and shall illuminate upon receipt of an alarm signal from the associated device(s) (i.e., electrical room smoke detector).
2) Provide one row of red (alarm) LED's. LED's in each row shall be arranged in columns, one column per type of alarm initiating device, and shall illuminate upon receipt of an alarm signal from the associated device(s) (i.e., electrical room smoke detector).

3) Provide one row of yellow (supervisory) LED's. LED's in each row shall be arranged in columns, one column per type of supervisory type device, and shall illuminate upon receipt of a supervisory signal from the associated device(s) (i.e., 2nd floor sprinkler valve supervisory switch).

4) The LED annunciator shall be provided with 25% spare LED's minimum. Each pair of LED's shall be labeled "Spare".

10. DACT Dialer:
   a. The system shall provide off premise communications capability using a digital alarm communications transmitter (DACT) for sending system events to multiple central monitoring station (CMS) receivers.
   b. The system shall provide the CMS(s) with point identification of system events using Contact ID or SIA DCS protocols.
   c. The system shall also transmit an alphanumeric system activity message, by event, to a commercial paging system of the owner's choice, using TAP Pager protocol.
   d. The system shall provide an individual CMS account for each tenant, and send the required signals to the one or more CMS(s) and account(s) specified by each tenant. In the event of a panel CPU failure during a fire alarm condition, the DACT degrade mode shall transmit a general fire alarm signal to the CMS.

11. Power Supply:
   a. System power supply(s) shall provide multiple power limited 24 VDC output circuits as required by the panel.
   b. Upon failure of normal (AC) power, the affected portion(s) of the system shall automatically switch over to secondary power without losing any system functions.
   c. Each system power supply shall be individually supervised. Power supply trouble signals shall identify the specific supply and the nature of the trouble condition.
   d. All standby batteries shall be continuously monitored by the power supply. Low battery and disconnection of battery power supply conditions shall immediately annunciated as battery trouble and identify the specific power supply affected.
   e. All system power supplies shall be capable of recharging their associated batteries, from a fully discharged condition to a capacity sufficient to allow the system to perform consistent with the requirements of this section, in 48 hours maximum.
   f. All AC power connections shall be to the building's designated emergency electrical power circuit and shall meet the requirements of NFPA 72. The AC power circuit shall be installed in conduit raceway. The power circuit disconnect means shall be clearly labeled FIRE ALARM CIRCUIT CONTROL and shall have a red marking. The location of the circuit disconnect shall be labeled permanently inside the each control panel the disconnect serves.

12. Reports:
   a. The system shall provide the operator with system reports that give detailed description of the status of system parameters for corrective action, or for preventative maintenance programs.
   b. The system shall provide these reports via the main LCD, and shall be capable of being printed on any system printer.
   c. The system shall provide a report that gives a sensitivity listing of all detectors that have less than 75% environmental compensation remaining. The system shall provide a report that provides a sensitivity (% Obscuration per foot) listing of any particular detector.
   d. The system shall provide a report that gives a listing of the sensitivity of all of the detectors on any given panel in the system, or any given analog/addressable device loop within any given panel.
   e. The system shall provide a report that gives a chronological listing of up to the last 1,740 system events.
   f. The system shall provide a listing of all of the firmware revision listings for all of the installed network components in the system.
2.3 INITIATING DEVICES

A. Addressable Smoke Detectors – Advanced Addressable:
1. The detectors shall be guaranteed in writing not to false alarm when configured by the factory trained certified technician. The detectors must provide at least 19 different environmental algorithms that allow the detector to provide superior false alarm immunity without the need for additional alarm verification delays.
2. The detectors shall have a tri-color LED to streamline system maintenance/inspection by plainly indicating detector status as follows: green for normal operation, amber for maintenance required, red for alarm.
3. Detectors shall utilize state of the art forward/backward light scattering technology, with improved detection for smoldering and flaming fire signatures. The detectors shall replace the need for ionization detectors due to improved response characteristics to flaming fires.
4. Detectors shall provide pre-alarm signal at 0.2% obscuration/ft. and a full alarm at 1.0% obscuration/ft. to meet the performance requirements of National Fire Protection Association Standard 76, Fire Protection of Telecommunications Facilities as a Very Early Warning Fire Detector (VEWFD).
5. The forward/backward light scattering technology shall provide improved immunity to spurious activation (deceptive phenomena). The detectors shall have a “No False Alarm Guarantee”.
6. The detectors shall be RoHS-compliant: it shall meet standards for Reduction of Hazardous Substances (RoHS) by reduction in lead content and other restricted substances.
7. The multi-criteria fire detectors shall be an intelligent digital photoelectric detector with a programmable heat detector. Detectors shall be listed for use as open area protective coverage, in-duct installation and sampling assembly installation and shall be insensitive to air velocity changes. The detectors’ communications shall allow the detectors to provide alarm input to the system and alarm output from the system within four (4) seconds. So as to minimize the effort required by the installing and maintenance technician to appropriately configure the detector to ensure optimal system design, the detectors shall be programmable as application specific. Application settings shall be selected in software for a minimum of 19 environmental fire profiles unique to the devices installed location.
8. The detectors shall be designed to eliminate the possibility of false indications caused by dust, moisture, RFI/EMI, chemical fumes and air movement while factoring in conditions of ambient temperature rise, obscuration rate changes and hot/cold smoke phenomenon into the alarm decision to give the earliest possible real alarm condition report.
9. The detectors shall be UL listed for operation in a 95% relative humidity (RH) environment.
10. The detectors shall be designed to eliminate calibration errors associated with field cleaning of the chamber.
11. The detectors shall support the use of a relay, or LED remote indicator without requiring an additional software address. Low profile, white case shall not exceed 2.5 inches of extension below the finish ceiling.
12. The detectors shall support the use of an ambient temperature warning signal at the panel. This temperature shall be user-configurable for the set temperature of the warning and the event type generated by the warning. This event can be used to trigger system logic.
13. For the detectors where required, there shall be available a locking kit and detector guard to prevent unauthorized detector removal.
14. UL Listed as “direct in-duct” mounting.
15. Available models:
a. Multi-Criteria incorporating 2 Optical sensors and 2 Thermal sensors with an operating temperature range of 32F to 120F. Nineteen selectable profiles. Polarity insensitive installation wiring. Three color LED.

B. Addressable Smoke Detectors – Standard Addressable:
1. The detector shall be guaranteed in writing not to false alarm when configured by the factory trained certified technician. The detector must provide up to 11 different environmental algorithms that allow the detector to provide superior false alarm immunity without the need for additional alarm verification delays.
2. The detector shall have a multicolor LED to streamline system maintenance/inspection by plainly indicating detector status as follows: green for normal operation, amber for maintenance required, red for alarm.
3. The multi-criteria smoke detector shall be an intelligent digital photoelectric detector with a programmable heat sensor. Detectors shall be listed for use as open area protective coverage, in duct installation, and sampling assembly installation and shall be insensitive to air velocity changes. The detector communications shall allow the detector to provide alarm input to the system and alarm output from the system within four (4) seconds. So as to minimize the effort required by the installing and maintenance technician to appropriately configure the detector to ensure optimal system design, the detectors shall be programmable as application specific. Application settings shall be selected in software for a minimum of eleven environmental fire profiles unique to the devices installed location.

4. The detector shall be designed to eliminate the possibility of false indications caused by dust, moisture, RFI/EMI, chemical fumes, and air movement while factoring in conditions of ambient temperature rise, obscuration rate changes and hot/cold smoke phenomenon into the alarm decision to give the earliest possible real alarm condition report.

5. The intelligent smoke detector shall be capable of providing three distinct outputs from the control panel. The outputs shall be from an input of smoke obscuration, a thermal condition or a combination of obscuration and thermal conditions. The detector shall be designed to eliminate calibration errors associated with field cleaning of the chamber.

6. The detector shall support the use of a relay, or LED remote indicator without requiring an additional software address. Low profile, white case shall not exceed 2.5 inches of extension below the finish ceiling.

7. For the detector where required, there shall be available a locking kit and detector guard to prevent unauthorized detector removal.

8. Where required, there shall be available a programmable remote lamp configurable to remotely duplicate the on-board LED status of another system device.

C. Smoke Detectors: Separate mounting base and detachable sensor head.

D. Duct Detector Housing:
1. Provide smoke detector duct housing assemblies with air sampling tube sized for duct location to mount an analog addressable detector.
2. Mounting base with auxiliary relay.
3. Provide remote alarm LED indicators and remote test station for each duct type smoke detector.
4. Wired and installed by Electrical Subcontractor. Coordinate exact location with Mechanical Subcontractor.

E. Heat Detectors:
1. Analog/Addressable Combination, Fixed Temperature/Rate of Rise:
   a. Fixed Temperature: 135 degrees F (57 degrees C).
   b. Rate of Rise: 15 degrees F (9 degrees C) per minute.
   c. Analog/Addressable Fixed Temperature: 200 degrees F (94 degrees C).
   d. Heat detector spacing shall comply with NFPA and Manufacturer's listing.
   e. Provide fixed temperature 200 degrees F for boiler rooms.

F. Detector Bases: Provide standard detector mounting bases suitable for mounted on 1-gang, 3-1/2-inch or 4-inch octagon box, and 4-inch square box.

G. Manual Pull Stations: Shall be analog/addressable, single action double action, single stage, recessed pull-lever, break glass, open circuit type. Finish of the station to be red with lettered instructions "PULL IN CASE OF FIRE."

H. Fire Protection Water Flow Switches and Valve Tamper Switches: For each existing switch, provide addressable module to monitor status of switch.

I. Combination Smoke/Fire Dampers:
1. To be provided by Mechanical Subcontractor in accordance with Division 21.
2. For each combination smoke fire damper, provide duct type smoke detector or area smoke detector with auxiliary contacts or addressable control module to initiate respective damper to close.
3. To control multiple smoke/fire dampers together, provide additional 20A relays as required.
J. Addressable Relays/Monitor and Control Modules: Form C normally open/normally closed dry relay contacts rated at 24VDC at 2 amps.
   1. Provide at least 2 contacts for transmitting signals to the WSU Campus Safety.

2.4 NOTIFICATION APPLIANCES

   A. Low Profile Horn Strobes/Low Profile Strobes:
      1. Provide wall mounted horn/strobe with audible output of 84dBA at 10 feet.
      2. Horn shall have a selectable steady or synchronized temporal output and shall be wired separately from strobes.
      3. Strobes shall provide synchronized flash outputs.
      4. Wall mounted strobe Candela ratings of 15cd, 30cd, 60cd, 75cd, 110cd. Candela ratings shall be determined by equipment supplier.
      5. Ceiling mounted strobe Candela ratings of 15cd, 30cd, 75cd, 90cd, 115cd, 150cd, and 177cd Candela ratings shall be determined by equipment supplier.
      6. Provide weatherproof enclosures for exterior applications.

PART 3 - EXECUTION

3.1 WIRING

   A. All wiring shall be in accordance with Manufacturer’s written recommendations and shall meet all applicable code requirements.
   B. All wiring shall be copper.
   C. No. 16 AWG minimum for signaling line circuits (SLCs)
   D. No. 14 AWG THHN minimum for audible and visual notification appliance circuits (NACs).
   E. No. 12 AWG THHN minimum for line voltage.
   F. Install wiring completely in metal raceways in accordance with Division 26 Section “Raceways for Electrical Systems.”
   G. Install wiring partially in metal raceways in accordance with Division 26 Section “Raceways for Electrical Systems.”
   H. Cable type shall be FPLP, FPLR.

3.2 EQUIPMENT INSTALLATION

   B. Duct Smoke Detectors: Connect each duct detector to fire alarm system so upon sensing smoke, fire alarm system goes into alarm. Coordinate location with Mechanical Subcontractor.
   C. Smoke Detectors: Install detectors indicated to be ceiling mounted not less than 4 inches from a side wall to the near edge. Install detectors located on the wall at least 4 inches but not more than 12 inches below the ceiling. For exposed solid joist construction, mount detectors on the bottom of the joists. On smooth ceilings, install detectors not over 30 feet apart in any direction. Install detectors no closer than 5 feet from air registers.
      1. Utilize standard addressable smoke detectors for all applications except the areas subject to vehicular traffic. Vehicular traffic locations shall utilize advance addressable style.
D. Audio/Visual Alarm Indicating Devices: Mount at 80 inches above the highest floor level within space or 6 inches below the ceiling, whichever is lower. Unless otherwise indicated, 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.

E. Fire Alarm Panel (FAP): Top of cabinet not more than 6 feet above the finished floor.

F. Remote Annunciator: Locate as indicated on the Drawings unless an alternate location is requested by the Authority having jurisdiction.

G. Smoke Dampers: All smoke dampers shall close upon sensing smoke from a smoke or duct detector. The HVAC unit shall be shut down upon activation. A smoke or duct detector shall be provided for each smoke damper.

3.3 GROUNDING

A. Ground equipment and conductor and cable shields. For audio circuits, minimize to the greatest extent possible ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5 ohm ground at main equipment location. Measure, record, and report ground resistance.

3.4 FIELD QUALITY CONTROL

A. All intelligent analog addressable devices shall be tested for current address, sensitivity, and user defined message.

B. All wiring shall be tested for continuity, shorts, and grounds before the system is activated.

C. All test equipment, instruments, tools, and labor required to conduct the tests shall be made available by the installing contractor.

D. The system including all its sequence of operations shall be demonstrated to the Owner, his representative, and the local fire inspector. In the event the system does not operate properly, the test shall be terminated. Corrections shall be made and the testing procedure shall be repeated until it is acceptable to the Owner, his representatives and the fire inspector.

E. At the final test and inspection, a factory trained representative of the system manufacturer shall demonstrate that the system functions properly in accordance with these specifications. The representative shall provide technical supervision, and participate during all of the testing for the system.

F. All fire alarm testing shall be in accordance with National Fire Alarm Code, NFPA 72 - 1999, Chapter 7.

G. A letter from the Contractor certifying that the system is installed entirely in accordance with the system manufacturer's recommendations and within the limitations of the required listings and approvals, that all system hardware and software has been visually inspected and functionally tested by a manufacturer's certified representative, and that the system is in proper working order.

END OF SECTION 28 31 00