Specifications for Bidding

Laboratory Renovations
Waste Water Treatment Plant
150 Ecology Drive
Jonesville, Michigan 49250

Owner: City of Jonesville
265 E. Chicago Street
Jonesville, Michigan 49250
Phone: 517.849.2104
www.jonesville.org

Engineer: Century A&E
277 Crahen Avenue NE
Grand Rapids, Michigan 49525
Phone: 616.456.5227
Fax: 616.456.5228
www.centuryae.com

May 10, 2021

CENTURY A&E
Facilities Design

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DRAWINGS INDEX

The following Drawings are separately bound and issued with the specification book and form a part of the Contract Documents.

Drawing Sheet No.	Title
CS	COVER SHEET
ARCHITECTURAL	**A-**
AD1.0	DEMOLITION FLOOR PLAN
A1.0	FLOOR PLAN
A6.0	INTERIOR ELEVATIONS
MECHANICAL	**M-**
DM1.0	DEMOLITION MECHANICAL FLOOR PLAN
M1.0	MECHANICAL FLOOR PLAN
M1.1	MECHANICAL SCHEDULES AND DETAILS
ELECTRICAL	**E-**
ED1.0	ELECTRICAL DEMOLITION PLAN
E1.0	ELECTRICAL PLAN

Notice is given hereby that:

CITY OF JONESVILLE, MICHIGAN

will accept bids for construction of:

WASTE WATER TREATMENT PLANT LABORATORY RENOVATIONS

according to Drawings and Specifications prepared by Century A&E, Inc. and described in general as:

Renovations to waste water treatment laboratory consisting of replacement of existing laboratory furnishings and equipment. Project includes removal and replacement of existing laboratory casework with new metal casework, fume hood, associated plumbing, new make-up air unit and exhaust, and electrical work.

Sealed bids will be received at the office of the OWNER until:

Thursday, May 27, 2021, at 1:00 PM EDT_at the City Hall_____

Bids will be opened publicly at 1:30 PM EDT at the Firestation. Bids received after that time will not be accepted.

Proposed Contract Documents will be emailed in PDF format on Monday, May 10, 2021 to all interested contractors. One full-sized copy of the drawings and specifications will be provided free of charge to each general contractor and may be picked up or mailed beginning Monday, May 10, 2021, at the address below. Please call first to confirm availability.

Century A&E Corporation
277 Crahen Ave. NE
Grand Rapids, Michigan 49525
Phone: 616.456.5227

There will be a **pre-bid meeting and site walk-thru for all interested contractors held on Tuesday, May 18, 2021, at 10:00 AM EDT**. The meeting will take place at the Owner's site located at 150 Ecology Drive, Jonesville, MI 49250.

The OWNER reserves the right to reject any or all bids and to waive irregularity in the bids and in the bidding.

ARTICLE 1 - BASIS OF PROPOSAL

1.1 The proposal is based on lump sum prices.

1.2 Bid security in the from of Certified Check, Cashier's Check or Bidder's Bond in the amount of 5% of the bidders base bid.

1.3 Bid sum to include cost of furnishing a Performance Bond and Labor and Material Payment Bond, each in the amount of 100% base bid.

ARTICLE 2 - QUALIFICATIONS OF BIDDERS

2.1 Bids are encouraged by all qualified contractors..

2.2 CONTRACTOR shall provide a list of subcontractors, and sub-subcontractors if applicable, to be approved by OWNER.

2.4 OWNER requests pricing be solicited and considered from the following sub-contractors:
Griffiths Mechanical
Clark Electric
Braman Roofing
Farnell Equipment Company

ARTICLE 3 - EXAMINATION OF CONTRACT DOCUMENTS AND SITE

3.1 Before submitting a Bid, each BIDDER shall:

3.1.1 examine the Contract Documents thoroughly;

3.1.2 visit the site to become familiar with local conditions that may in any manner affect cost, progress or performance of the Work; and

3.1.3 become familiar with all laws, rules and regulations that may in any manner affect cost, progress or performance of the Work; and

3.1.4 study and carefully correlate BIDDER's observations with the Contract Documents.

ARTICLE 4 - INTERPRETATION

4.1 Questions about the meaning or intent of the Contract Documents shall be submitted to ENGINEER not less than seven (7) days prior to date of opening of Bids. Replies will be issued by Addendum mailed or delivered to Planholders of Record three (3) days before Bids are due. Only answers given by Addendum shall be binding. Oral and other interpretations or clarifications shall be without legal effect.

ARTICLE 5- CONTRACT TIME

5.1 Time is of the essence on this project and the CONTRACTOR's proposal will be reviewed in accordance with the proposed completion time as well as project cost. The project involves renovation of two laboratory spaces and will need to be coordinated so the owner can maintain operations in adjoining areas for the duration of construction.

ARTICLE 6 - PRE-BID MEETING

6.1 A Pre-Bid Meeting will be held at the Jonesville Waste Water Treatment Plan, 150 Ecology Drive at 10:00 AM EDT on Tuesday, May 18 to answer questions regarding to the plans, specifications and field conditions.

6.2 Attendance of the Pre-Bid Meeting is encouraged.

6.3 A tour of the proposed work site will be conducted.

ARTICLE 7 - BID PREPARATION

7.1 The Bid is to be submitted complete in all respects on the Proposal Form with all attachments as requested. An incomplete proposal shall be cause for rejection of the Bid.

ARTICLE 8 - SUBMISSION OF BIDS

8.1 Bids, addressed to the attention of:

Jeff Gray, City Manager
City of Jonesville
265 E. Chicago Street
Jonesville, MI 49250

will be received until 1:00 PM local time on the 27th day of May, 2021.

8.2 Each Bid will be in a sealed, plain 9 inch x 12 inch envelope with the title BID ENCLOSED FOR JONESVILLE WASTE WATER TREATMENT PLANT LABORATORY RENOVATIONS.

ARTICLE 9 - OPENING OF BIDS

9.1 A public bid opening will be held at 1:30 PM EDT on May 27, 2021 at City of Jonesville Fire Station, 114 W. Chicago Street, Jonesville, MI 49250.

9.2 Competitive Bid tabulations will be available on request.

ARTICLE 10 - AWARD OF CONTRACT

10.1 The Contract will be awarded or all proposals rejected within 30 days after date of bid opening.

10.2 All Bids shall remain firm for 30 days after bid opening.

10.3 The OWNER reserves the right to reject any or all Bids.

10.4 Concurrently with the execution and delivery or Agreement, CONTRACTOR shall deliver to OWNER required certificates of insurance as specified.

ARTICLE 11 - SITE AND EASEMENTS

11.1 All work under this contract is entirely on the premises of Jonesville Waste Water Treatment Plant.

ARTICLE 12 - PRE-CONSTRUCTION MEETING

12.1 A Pre-Construction Meeting will be held at Jonesville Waste Water Treatment Plant, 150 Ecology Dr., Jonesville, MI 49250. CONTRACTOR will be given the date and time when contract is awarded.

ARTICLE 13- EQUIPMENT AND MATERIALS TO BE FURNISHED BY OWNER

13.1 Loose furnishings and equipment to be placed upon completion of project.

END OF INSTRUCTIONS

WASTE WATER TREATMENT PLANT LAB RENOVATIONS
CITY OF JONESVILLE, MICHIGAN

May 10, 2021

City of Jonesville
Attn: Mr. Jeff Gray
265 E. Chicago Street
Jonesville, MI 49250

Dear Mr. Gray:

Having carefully examined the site of the proposed work; being fully informed of the conditions to be met in the prosecution of the work; having read and examined the Contract Documents and Drawings applicable to this work; and agreeing to be bound accordingly; the undersigned proposes to furnish all necessary labor, materials, and equipment to complete the work indicated on the Drawings and described in the Specifications for the following Lump Sum Bid Price.

BASE BID PRICE:

_____

_____ Dollars ($_____).

TAXES: Bid sum includes all applicable taxes, including Michigan Sales Tax. Confirm that your company can pay Sales and Use Tax. ___Yes ___ No

COST OF BONDS: Bid Proposal includes 5% Bid Security and includes cost of furnishing a Performance Bond and Labor and Material Payment Bond, each in the amount of 100% of Base Bid. ___ Yes ___ No

VOLUNTARY ALTERNATE 1:

CONTRACTOR shall provide the OWNER with a lump sum cost to be (deducted) (added) (from) (to) the Base Bid Price if the material, equipment and labor costs associated with:

(Deductive) (Additive) Voluntary Alternate 1: _____

_____ DOLLARS ($_____)

VOLUNTARY ALTERNATE 2:

CONTRACTOR shall provide OWNER with a lump sum cost to be (deducted) (added) (from) (to) the Base Bid Price if the material, equipment and labor costs associated with:

_____

_____

(Deductive) (Additive) Voluntary Alternate 2: _____

_____DOLLARS ($)_____

ADDENDA:

Receipt of Addenda _____ through _____ is acknowledged.

FEES FOR ADDITIONAL WORK: There will be a fee of ___% applied to the total cost of materials purchased and work completed by a contractor's own forces. There will be a fee of ___% applied to the total cost of work completed by a cubcontractor. These percentages represent both overhead and profit.

CREDIT FOR DELETED WORK: Should any work be deleted from the Contract by order of the Owner, full cost savings realized thereby will be credited to the Owner

COMPLETION DATE:

5.1 Substantial Completion of the Work must be achieved by December 17, 2021, and the Work must be completed (i.e., Final Completion achieved) by January 7, 2022.

5.2 OWNER and CONTRACTOR recognize that time is of the essence of this Agreement and recognize the potential for financial loss suffered by OWNER in the event that CONTRACTOR fails to complete the Work within the Contract Time, therefore, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty), CONTRACTOR shall pay OWNER an amount Five Hundred Dollars ($500) for each calendar day that expires after January 7, 2022, until Final Completion of the Work.

BID BREAKDOWN:

Architectural Trades:	$_____
Laboratory Furnishings	$_____
Plumbing	$_____
Mechanical/HVAC	$_____
Electrical	$_____
TOTAL LUMP SUM PROJECT COST:	**$_____**

SUBCONTRACTORS:

Bid is submitted on the basis of the use of the following Subcontractors:

WORK ITEM	FIRM	CITY
General Trades		
Sealants		
Painting		
Flooring		
Laboratory Equipment		
Plumbing		
Mechanical/HVAC		
Roofing		

EQUIPMENT:

BID is submitted on the basis of using the following equipment manufacturers:

EQUIPMENT DESCRIPTION	EQUIPMENT MANUFACTURER
Laboratory Furnishings	_____
Roof Make-up Air Units	_____

BIDDER:

(CORPORATE SEAL)

_____
Name of Company

_____
Address

_____

_____
Name Title

_____
Signed Date

MASTER CONSTRUCTION MANAGEMENT AGREEMENT

THIS MASTER CONSTRUCTION MANAGEMENT AGREEMENT ("**Agreement**") is made on the _____ day of _____, 2021_____, ("**Effective Date**") between _____ _____, a Michigan _____, ("**Construction Manager**"), and City of Jonesville, a Michigan city of 265 E. Chicago Street, Jonesville, Michigan 49250 ("**City of Jonesville**"). City of Jonesville and Construction Manager are each individually referred to as a "**Party**" and collectively as the "**Parties**."

Preliminary Statement

A. City of Jonesville owns various properties that require demolition, renovation, and/or construction from time to time.

B. City of Jonesville may engage Construction Manager from time to time to serve as its construction manager at risk on one or more Projects so long as this Agreement is in effect.

C. If City of Jonesville desires to engage Construction Manager, City of Jonesville shall issue a Work Order, and Construction Manager agrees to perform construction management services to fully construct the Project and perform the work described in the Work Order in accordance with the terms of this Agreement and any supplemental terms in the Work Order ("**Work**").

Agreement

In consideration of the mutual covenants contained in this Agreement, the Parties agree as follows:

1. **Contract Documents**.

1.1. The Contract Documents ("**Contract Documents**") form the contract between City of Jonesville and Construction Manager and represent the entire and final integrated agreement between City of Jonesville and Construction Manager with respect to the Work. The Contract Documents are incorporated into this Agreement by reference, and supersede all prior oral or written agreements, if any, between City of Jonesville and Construction Manager, including any terms and conditions in any proposals prepared by Construction Manager. Any statement, representation, promise or inducement not set forth in the Contract Documents is null and void and not binding on the Parties.

1.2. The Contract Documents consist of the following:

(a) This Agreement as fully executed by the Parties;

(b) The Work Order for a Project;

(c) The Project Manual, plans, drawings and specifications for a Project, if applicable, prepared by Architect (as defined below in Section 4.2), as amended or supplemented and attached or referenced in the Work Order;

(d) Any Change Order or Change Directives signed by City of Jonesville for a Project;

(e) The advertisement of invitation to bid with the Project details;

(f) Pre-bid meeting minutes approved by City of Jonesville, if any;

(g) The Notice of Award; and

(h) The Notice to Proceed.

1.3. If a Project Manual has been prepared for the Project, Construction Manager acknowledges that the Project Manual was prepared by the Architect and includes information that is more detailed than this abbreviated Agreement. By entering into a Work Order, Construction Manager will be deemed to acknowledge having received and reviewed the Project Manual as part of the request for proposal it received. With respect to inconsistencies in the Plans, Specifications and Drawings, Section 1.4 shall govern. To the extent that there are also policies, procedures, guidelines, and requirements that are more detailed or not addressed in this Agreement and/or a Work Order and not inconsistent with the terms of this Agreement or the Work Order, Construction Manager agrees to comply with the terms of the Project Manual. However, to the extent there are provisions in the Project Manual inconsistent with this Agreement, the provisions of this Agreement expressly supersede the inconsistent provisions of the Project Manual irrespective of whether the inconsistent provision is expressly noted in this Agreement as superseded by this Agreement.

1.4. Notwithstanding the specificity of Section 1.3 above, as a general rule, the intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by Construction Manager. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by Construction Manager shall be required to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results given Construction Manager's extensive experience and expertise with the construction of similar construction projects and Construction Manager's experience with City of Jonesville. In the event of conflicts between or among the Contract Documents and Applicable Laws, Construction Manager shall (a) provide the better quality or greater quantity of Work, or (b) comply with the more stringent requirements—either or both in accordance with the Architect's or City of Jonesville's interpretation. The terms and conditions of this Section, however, shall not relieve Construction Manager of any of its other obligations under the Contract Documents. Other conflicts between or among the Contract Documents shall be resolved under the following rules of construction:

(a) Submit a Request for clarification to the Architect for the Project Manual, which as noted above includes the Architect's Plans, Specifications and Drawings of the Work. Response governs.

(b) Dimensions shown on Drawings shall govern, even though they may differ from dimensions scaled on the Drawings;

(c) Drawings of larger scale shall govern over those of smaller scale of the same date;

(d) Specifications shall govern over Drawings;

(e) Documents of later date shall always govern; and

(f) This Agreement, as may be amended, shall govern over all other documents except the Work Order.

Any Shop Drawings or other submittals (collectively, "**Submittals**") that change the Contract Documents shall only be deemed part of the Contract Documents if Construction Manager expressly and clearly identifies the changes in such Submittals and requests Architect's and City of Jonesville's approval to modify the Contract Documents through the applicable Submittals and such approvals are given by Architect and City of Jonesville. The terms and conditions of this Section, however, shall not relieve Construction Manager of any of the obligations set forth elsewhere in the Contract Documents.

2. **General Scope of Services**.

2.1. When a Work Order is executed for a Project, City of Jonesville and Construction Manager acknowledge and agree that the Project consists of the Work on the Property as more particularly described in the Contract Documents. "**Work**" includes all preconstruction and construction work and other services required to be performed by Construction Manager as authorized by a Work Order under the Contract Documents (whether fully completed or not), and including any work or other services reasonably inferable therefrom and necessary to produce City of Jonesville's intended results as disclosed to Construction Manager, and all labor, materials, equipment and services provided or to be provided by Construction Manager to fulfill Construction Manager's obligations. Construction Manager further acknowledges and agrees that it shall be responsible for carefully reviewing the Drawings, Specifications and other Contract Documents prepared by Architect before construction commences, and based on Construction Manager's standard of care set forth in Section 2.2 below, Construction Manager shall promptly

notify Architect and City of Jonesville of any discrepancies in the Contract Documents and any other concerns that might create a violation of Applicable Laws or produce challenges in obtaining necessary permits and approvals for the Project. If Construction Manager fails to perform in accordance with these requirements, Construction Manager shall be responsible to City of Jonesville for all additional costs it incurs to the extent of Construction Manager's failure.

2.2. Construction Manager accepts a relationship of trust and confidence in favor of City of Jonesville and covenants with City of Jonesville to, at a minimum, perform the Work in good faith and in a manner consistent with Construction Managers of similar experience in projects similar to the Project and agrees to furnish its services for the Project in an expeditious and economic manner so as to at all times promote the best interest of, and to the satisfaction of, City of Jonesville. Construction Manager recognizes there is an extra degree of care required to construct the Work with respect to safety, protection of certain infrastructure, construction means and methods, cleanliness of the site, health standards and compliance with other Applicable Laws, and protection of existing utilities, adjacent streets, and property. City of Jonesville assumes no responsibility or liability for the physical condition or safety of the Work and the Property and there shall be no change in the Contract Sum (as defined below) or in the Construction Schedule (as defined below) due to Construction Manager's or Subcontractor's (as defined below) failure to comply with the provisions of this Section, except as expressly provided otherwise in this Agreement.

2.3. Construction Manager shall, and shall cause its Subcontractors to, perform the Work in accordance with good and sound practices within the construction industry, generally prevailing and accepted industry standards applicable to the Work, requirements of any warranties applicable to the Work and all applicable laws, rules, regulations, codes and ordinances ("**Applicable Laws**").

2.4. Construction Manager has examined the Contract Documents describing the Work (as required in Section 2.1), condition of the Property where the Work will be performed (including verification of field conditions, current improvements, and utility locations), become familiar with local conditions, procured all investigative reports required for the Project, investigated the nature, locality and site of the Project and the conditions in which the Work is to be performed, all of which has allowed Construction Manager to establish the Construction Schedule and the Contract Sum. Construction Manager is not relying upon any opinions or representations of City of Jonesville or any of City of Jonesville's agents or representatives. Construction Manager has required, or will require, all Subcontractors to perform the same examination for the portion of the Work they will be performing, and has entered into this Agreement on the basis of its own investigations and those of its Subcontractors.

2.5. If Construction Manager reasonably requires any additional information regarding any concealed condition of the Project that is unusual and unanticipatable regarding the conditions of the Project after performing its obligations under Section 2.4, Construction Manager must request this information from City of Jonesville promptly after the execution of this Agreement so as to avoid any delay in the timely progress of the Project and an unreasonable increase in the cost of the Project to City of Jonesville. Under the foregoing conditions, City of Jonesville will provide such information at its expense.

2.6. Construction Manager recognizes that any information requiring the expertise or report of a professional, such as a surveyor, architect or other consultant, shall not be a representation or warranty by City of Jonesville of its accuracy or completeness. Construction Manager and its Construction Manager's Agents must carefully examine in accordance with its standard of care under this Agreement all reports and other information furnished by or through City of Jonesville for completeness and accuracy for Construction Manager's performance of its Work.

2.7. In accordance with the Construction Schedule, Construction Manager shall fully execute the Work, including, but not limited to, construction and other services required by this Agreement, which shall further include all labor, supervision, materials, equipment, and services provided or to be provided by Construction Manager to fulfill its obligations, and to perform any additional services not specifically described in the Work if such services are consistent with this Agreement and a reasonable inference may be drawn from them that these services are necessary to produce the results intended by this Agreement.

2.8. To the extent that different options may be selected by City of Jonesville regarding the Work, City of Jonesville shall notify Construction Manager of City of Jonesville's selections within seven (7) days after notice from Construction Manager that selection of the applicable option must be made in order to avoid delays in completion of the Project. In the event City of Jonesville fails to timely make any selection, Construction Manager may, with prior notice to City of Jonesville, either proceed with construction with one of the available options or delay construction as an Uncontrolled Condition (as defined in Section 4.5) in accordance with such procedure in Section 4.5 until the

selection is made by City of Jonesville. In the event Construction Manager elects to delay construction as an Uncontrolled Condition, City of Jonesville shall be responsible for all reasonable out-of-pocket additional costs incurred by Construction Manager as a result of such delay. Notwithstanding the foregoing, Construction Manager agrees that all options for selection shall be documented in and furnished to City of Jonesville in accordance with the Construction Schedule.

2.9. Construction Manager may suggest alternative cost saving approaches for consideration by City of Jonesville, however any alternatives suggested by Construction Manager must be approved in writing by City of Jonesville prior to incorporation into the Work.

2.10. Construction Manager shall comply with City of Jonesville's then current internal policies, procedures and rules applicable to City of Jonesville's personnel and/or safety requirements associated with the Work including any infection control procedures. In its sole discretion, City of Jonesville may require Construction Manager to cause all persons under its control, including Subcontractors' personnel, to bring current all TB vaccination(s), flu shot(s), and other health-related immunizations. City of Jonesville may also require such parties to complete subsequent vendor orientation programs from time to time during the term of this Agreement and their attendance shall be mandatory and without charge to City of Jonesville.

3. **Project Managers**.

3.1. City of Jonesville shall designate a person, as set forth in the Work Order, who will serve as Construction Manager's single point of contact and who is the only authorized representative to make decisions and provide instructions on behalf of City of Jonesville with respect to the day-to-day operations of the Project and performance of the Work ("**City of Jonesville Project Manager**"). The City of Jonesville Project Manager shall be authorized on behalf of City of Jonesville to execute Change Orders and Construction Change Directives.

3.2. Construction Manager shall designate a person, as set forth in the Work Order, who will serve as Construction Manager's project representative and who is authorized to make decisions and provide instructions on behalf of Construction Manager with respect to the day-to-day operations of the Project and performance of the Work ("**Construction Manager's Project Manager**"). Construction Manager's Project Manager shall not be substituted during the Project without the prior written consent of City of Jonesville, which consent may be withheld in its sole discretion, unless Construction Manager's Project Manager's employment with Construction Manager is to be terminated, in which event, City of Jonesville shall not unreasonably withhold its approval of a new Construction Manager's Project Manager, so long as such person exemplifies the business acuity and ethics required by City of Jonesville.

4. **Time for Completion**.

4.1. Construction Manager shall use its best efforts to commence the Work on the date set forth in the Construction Schedule or within seven (7) days after written notice from City of Jonesville to proceed as provided for a Project in the Work Order ("**Notice to Proceed**") and, notwithstanding the commencement date of the Work by Construction Manager, Construction Manager shall perform the Work in accordance with the Construction Schedule as described in the Work Order ("**Construction Schedule**"), including the critical path, milestone dates, Substantial Completion and Final Completion dates. With each Payment Application (as defined below), Construction Manager shall provide City of Jonesville with the Delay Report (as defined in Section 8.5(c) below). Notwithstanding the foregoing, the Construction Schedule may not be revised without City of Jonesville's prior written approval.

4.2. The Project shall be deemed to have achieved "**Substantial Completion**" when all of the following have occurred:

(a) The Work or, if the Contract Documents permit the Work to be completed in phases, the designated portion thereof is sufficiently complete in accordance with the Contract Documents so that City of Jonesville can occupy or utilize the Project or if a phased Project, the portion thereof for its intended use;

(b) City of Jonesville's architect, if and as designated in the Work Order, ("**Architect**"), has signed and delivered to City of Jonesville a "Certificate of Substantial Completion" certifying that the Work is constructed in accordance with the Contract Documents and any City of Jonesville signed Change Orders and Construction Change Directives;

(c) A permanent Certificate of Occupancy and any other necessary governmental approvals have been issued, and if applicable, the Project has received the requisite LEED certification;

(d) Updated certificates of insurance or policies, as required by City of Jonesville, together with additional insured endorsements, have been supplied to City of Jonesville;

(e) All warranties, manuals, certificates of inspection, tests and approvals, all bonds, if applicable, copies of all test results and as-built documents for the Project are delivered to City of Jonesville as required for the Work, and Construction Manager has furnished City of Jonesville with a loose leaf binder and electronic file in mutually agreeable format compiling all warranties, instructions, procedures and schedules for proper service, maintenance and use of the Project;

(f) All utilities are transferred into City of Jonesville's name and keys and other entry codes are delivered to City of Jonesville, and

(g) Only Punch List Items (as defined below) remain to be completed.

4.3. "**Final Completion**" shall deem to have occurred when all of the following have occurred:

(a) All Punch List Items are completed to the satisfaction of City of Jonesville;

(b) City of Jonesville can continue to use the Property and the Work for its intended purpose;

(c) If applicable, the warranty bond as described in Section 10.2 of this Agreement is delivered to City of Jonesville;

(d) All other documents establishing payment or satisfaction of obligations, including, without limitation, releases and waiver of liens, claims, security interests or encumbrances arising out of this Agreement (to the extent and in such form as shall reasonably be approved by City of Jonesville) are signed and delivered to City of Jonesville and City of Jonesville has verified payment;

(e) All other conditions precedent to final payment under this Agreement have been satisfied; and

(f) Construction Manager has delivered final, as-built drawings to City of Jonesville.

4.4. "**Punch List Items**" are only such unfinished portions of the Work which are incidental portions of the Work, will not hinder or prevent City of Jonesville's occupancy and do not total in the aggregate more than five percent (5%) of the Contract Sum to complete. Punch List Items, if any, shall be completed as soon as reasonably possible but in any event within thirty (30) days after Substantial Completion, subject to Uncontrolled Conditions (as defined below) which shall extend the time period to complete the Punch List Items by a reasonable period of time necessary to complete the Punch List Items impacted by the Uncontrolled Condition but not to exceed an additional sixty (60) days.

4.5. Neither the Substantial Completion date nor the Final Completion date, as established in the Construction Schedule for a Project, shall be extended except (i) when mutually agreed upon in writing by City of Jonesville and Construction Manager, or (ii) for reasonable periods of time resulting from delays caused by "**Uncontrolled Conditions**" which are expressly and only defined as unusual and unanticipatable weather conditions, power/water/fuel outages or shortages, war, acts of terrorism, and material shortages, fire or other casualty, and acts or omissions of City of Jonesville (including those arising from Section 2.8 above), its agents or employees or City of Jonesville's Vendors (as defined below) and in such instance(s) that directly and materially cause a delay in Construction Manager's Work; provided in each of the foregoing events Construction Manager notifies City of Jonesville (i) within twenty-four (24) hours by telephone or electronic mail of the delay and (ii) follows up in writing detailing the impact to the Construction Schedule within five (5) business days of the occurrence of the event causing the delay.

4.6. Construction Manager acknowledges and recognizes that City of Jonesville is entitled to full and beneficial occupancy and use of the completed Work upon the date set forth in the Construction Schedule for

Substantial Completion, and that City of Jonesville has made, or will make, important business commitments based upon Construction Manager's achieving Substantial Completion and Final Completion of the Work no later than those dates specified the Construction Schedule. Construction Manager further acknowledges and agrees that if Construction Manager fails to achieve Substantial Completion of any portion of the Work by the date for Substantial Completion required in the Construction Schedule, City of Jonesville may sustain extensive damages and serious loss as a result of such failure. The exact amount of such damages will be extremely difficult to ascertain. Therefore, City of Jonesville and Construction Manager agree that if Construction Manager fails to achieve Substantial Completion of the Work by the date set forth in the Work Order, City of Jonesville shall be entitled to liquidated damages and not as a penalty and continuing each day until the actual date of the Substantial Completion is achieved by Contractor ("**liquidated damages**") in an amount agreed to by the Parties in the Work Order if so provided in the Work Order. Such liquidated damages are hereby agreed to be a reasonable pre-estimate of damages City of Jonesville will incur as a result of delayed completion of the Work. City of Jonesville may deduct liquidated damages described herein from any unpaid amounts then or thereafter due Construction Manager under this Agreement or any other agreement City of Jonesville or its affiliates has with Construction Manager. Any liquidated damages not so deducted from any unpaid amounts due Construction Manager shall be payable to City of Jonesville upon demand, together with interest from the date of the demand at a rate equal to the Interest Rate (as defined below).

4.7. When a Project has an existing operating facility located on the Property or when the Property is a small site, Construction Manager shall furnish, for City of Jonesville's review and approval, a plan for staging and duration of construction activities on the Property, which shall take into account the existing use and size of the site ("**Staging Plan**"). Construction Manager shall comply with the Staging Plan in performing its Work.

5. **Contract Price**.

5.1. City of Jonesville shall pay Construction Manager for its proper performance of the Work to construct the Project a fee in the amount set forth or calculated in the Work Order ("**Contract Sum**"). Unless otherwise provided in the Work Order, the Contract Sum includes all the costs incurred by Construction Manager in connection with its performance and completion of the Work and the Project as required by this Agreement, including, but not limited to the following:

(a) The cost of site investigations, preparations and development, including landscaping (if applicable);

(b) The cost of all building construction material and equipment (including equipment rentals), subcontract labor, utilities and taxes, including, without limitation, costs customarily defined as general conditions costs and reimbursable expenses;

(c) All governmental costs and fees, including building permits (which may only be specified under an allowance if so stated in the Schedule of Values when the cost is not yet determined), construction permits, inspections, bonds, insurance and other governmental or municipal requirements;

(d) All fees for inspections and certifications required of the Work;

(e) All reimbursable costs (e.g., telephone, reproduction, utilities and travel costs);

(f) All labor and employment costs, including all overtime and fringe benefits;

(g) All cash discounts, trade discounts, rebates and refunds and all proceeds from the return of surplus materials and equipment shall be deducted from the Cost of the Work and Construction Manager shall make reasonable efforts to obtain all such discounts, rebates and refunds which may be available;

(h) All profit, overhead, administrative and similar costs (including, without limitation, all insurance expenses) and profit (including, without limitation, Construction Manager's fee); and

(i) All cleanup costs.

5.2. The Contract Sum shall not be changed, subject only to additions and deductions authorized by City of Jonesville pursuant to a Change Order or Construction Change Directive. Any costs for the Work in excess of

the Contract Sum shall be paid by Construction Manager without reimbursement by City of Jonesville, unless pursuant to this Agreement the Contract Sum has been adjusted by a Change Order to the Work Order to allow such sum to be included in the Contract Sum.

6. **Progress Payments; Schedule of Values**.

6.1. If a Schedule of Values is not attached or included in a Work Order, the Construction Manager shall submit to the Architect and City of Jonesville for approval before the first Payment Application a "**Schedule of Values**" allocating the entire Construction Manager Sum to the various portions of the Work generally consistent with the Preliminary Schedule of Values in the Work Order, and prepared in such form and supported by such data to substantiate its accuracy as the Architect and City of Jonesville may require. The Construction Manager's and each Construction Manager's Agent's Schedule of Values shall include a trade payment breakdown for the Work for which each is responsible, such breakdown being submitted on a uniform standardized form approved by the Architect and City of Jonesville. The form shall be divided in detail sufficient to exhibit sections of the Work, and/or by convenient units, consistent with the descriptions in the Construction Schedule, and shall be updated as required by either City of Jonesville or the Architect as necessary to reflect (1) description of Work (listing labor and material separately), (2) total value, (3) percent of the Work completed to date, (4) value of Work completed to date, (5) percent of previous amount billed, (6) previous amount billed, and (7) current percent complete. Any Schedule of Values which fails to include sufficient detail, is unbalanced or exhibits "front-loading" of the value of the Work shall be rejected. If a Schedule of Values had been initially approved by City of Jonesville and Architect and subsequently relied upon, but later found improper for any reason, sufficient funds shall be withheld from future Payment Application to ensure an adequate reserve (exclusive of Retainage, as defined below) to complete the Work on a Project. Only after this Schedule of Values is approved in writing by the Architect and City of Jonesville shall it be used as a basis for reviewing the Construction Manager's Payment Applications and shall it be considered part of the Contract Documents as a replacement to the prior Schedule of Values approved by City of Jonesville for a Project.

6.2. For each Project, Construction Manager shall submit a Payment Application, as defined below in Section 6.3, to City of Jonesville on a monthly basis based on approximate percentage of the Work completed during the prior month according to the Schedule of Values. Upon meeting the conditions specified in Section 6.3, Construction Manager shall be paid ninety percent (90%) of the monthly invoice. Upon Construction Manager achieving Substantial Completion and, if necessary, upon City of Jonesville obtaining approval from City of Jonesville's construction lender, the outstanding balance of ten percent (10%) of the invoiced amount retained by City of Jonesville, which is also referred to as "**Retainage**," shall be reduced to the greater of five percent (5%) of the Contract Sum or two (2) times the cost to complete the Punch List Items as reasonably determined by City of Jonesville, with such remaining amount to paid within thirty (30) days after Construction Manager achieves Final Completion of a Project.

6.3. As a condition to City of Jonesville's obligation to make payment, Construction Manager's payment application must include (i) an itemized invoice indicating the percentage of the Work completed for each portion of the Work covered by the invoice for a Project and showing in detail all costs incurred by Construction Manager (including Construction Manager's Agents as defined below) in connection with the preceding month's Work for which Construction Manager or its Construction Manager's Agents received payment and consistent with the Schedule of Values, (ii) a description of the Work that has been completed so that City of Jonesville can verify such Work (either independently or through its Architect or other consultant), (iii) fully-executed lien waivers and sworn statements of Construction Manager and any or all of its Subcontractors, suppliers, materialmen, laborers, or others working by or through them on the Project, including, without limitation, their employees and agents ("**Construction Manager's Agents**"); provided, however, that Construction Manager shall only be required to provide lien waivers for amounts disbursed for the period up to and including the prior month's progress payment (collectively, "**Payment Application**"). Payment will then be made to Construction Manager within thirty (30) calendar days after Construction Manager submits all documents and information required above to City of Jonesville (and City of Jonesville can verify the same) for the prior month's costs, subject to City of Jonesville's rights to pay Construction Manager's Agents directly pursuant to Section 8.3 below.

7. **Final Payment and Suspension of Services**.

7.1. Final payment of the balance of the Contract Sum for a Project shall be paid by City of Jonesville within thirty (30) days after Final Completion, including, without limitation Construction Manager's delivery to City of Jonesville of unconditional lien waivers for all services and construction performed by Construction Manager and Construction Manager's Agents.

7.2. Any progress payment or final payment remaining unpaid fifteen (15) days after it is due shall bear interest at the rate of five percent (5%) per annum ("**Interest Rate**") until paid.

7.3. Construction Manager shall have the right to suspend its performance under this Agreement and the applicable Work Order in the event any payment is not made within fourteen (14) days after it becomes due, unless such failure to make payment is the subject of a bona fide dispute between City of Jonesville and Construction Manager in which case, Construction Manager shall continue to perform under this Agreement and the applicable Work Order and City of Jonesville shall pay any amounts that are not in dispute for which Construction Manager is entitled to payment.

7.4. Title to the Work shall vest in City of Jonesville upon the earlier of (i) the payment for the completed Work by City of Jonesville, or (ii) incorporation of the portion of the Work into the Project.

8. **Subcontractors; Project Management**.

8.1. Construction Manager itself may self-perform the Work and supply equipment, materials and supplies for the Project. Such services, equipment, materials and supplies for the Work may instead be supplied by or through subcontractors ("**Subcontractors**") under separate written subcontracts with Construction Manager using a form of subcontract, which shall include a Schedule of Values for the applicable Work, that is pre-approved by City of Jonesville ("**Subcontracts**"). All Subcontractors and Subcontracts shall be subject to the approval of City of Jonesville, which approval shall not be unreasonably withheld. If a Subcontractor is listed on City of Jonesville's Approved Subcontractor List ("**Approved Subcontractor**"), receipt of which Construction Manager acknowledges, City of Jonesville's approval of the Subcontractor shall be deemed given to Construction Manager. In all cases, copies of all fully-executed Subcontracts for each Project shall be delivered to City of Jonesville prior to commencement of the portion of the Work subject to the Subcontract. In addition, all Subcontracts shall designate City of Jonesville as a third party beneficiary who is entitled to enforce any and all terms of the Subcontracts upon the neglect or failure of Construction Manager to do so, freely permit an assignment of the Subcontract upon a termination of Construction Manager under this Agreement and the applicable Work Order, mandate joinder of the Subcontractor in any dispute between City of Jonesville and Construction Manager if so requested by a Party, and cause all Subcontractors to comply with the terms of this Agreement, including, without limitation, the insurance, indemnification, warranties, bond and audit requirements.

8.2. For any changes in the Work that are proposed as a Change Order or Construction Change Directive that increases the Contract Sum, Construction Manager shall obtain three (3) bids for each portion of the Work to be performed by Subcontractors and furnish copies of the bids to City of Jonesville for review and approval.

8.3. Construction Manager agrees that it will perform the Work and all services related thereto under this Agreement (including, without limitation, that it will manage, coordinate and supervise the construction activities under the Subcontracts) consistent with the standard of care that other similarly situated construction managers of similar reputation, experience, and skills would perform and according to standards of professional construction management and good industry practice and Construction Manager shall endeavor to cause such construction to take place in the most economical and expeditious manner and in a manner which is consistent with the terms and conditions of this Agreement. Construction Manager shall cooperate in good faith with the Architect, City of Jonesville and it agents but Construction Manager shall be responsible for construction means, methods, techniques, sequences or procedures used by it and its Construction Manager's Agents, including the Subcontractors, in performance of the Subcontracts and shall be responsible to City of Jonesville for the failure of any Construction Manager's Agent, including any Subcontractor, in its performance except when Uncontrolled Conditions directly cause Construction Manager's Agent's failure to perform as required hereunder. In addition, if the Contract Documents specify that City of Jonesville will be engaging separate contractors or other vendors (collectively, "**City of Jonesville's Vendors**") to perform work or services concurrently with Construction Manager's Work at the Property, Construction Manager's Work shall include coordinating the activities of Construction Manager and Construction Manager's Agents with City of Jonesville's Vendors to allow timely and coordinated good faith performance by all parties. If City of Jonesville's Vendors shall act in bad faith in connection with coordination of activities, Construction Manager shall as soon as practicable notify City of Jonesville and Architect of the specific bad faith actions so as to allow City of Jonesville or Architect to timely address the issue with City of Jonesville's Vendors. Should Construction Manager fail to timely notify City of Jonesville, City of Jonesville shall have no liability for any additional costs or delays in Construction Manager's Work resulting from the bad faith of City of Jonesville's Vendors. If timely notice is given to City of Jonesville and Architect, delays resulting from City of Jonesville's Vendors' bad faith shall constitute an Uncontrolled Condition.

8.4. Construction Manager shall promptly pay each Construction Manager's Agent upon receipt of payment from City of Jonesville (provided the Subcontract permits payment under such same terms). Provided City of Jonesville complies with the applicable provisions of the Michigan Construction Lien Act, City of Jonesville may, but shall not have the obligation, to pay directly to any Construction Manager's Agent the amount owed as such party has properly documented to City of Jonesville under Michigan's Construction Lien Act, and deduct such amounts from payment directly to Construction Manager.

8.5. Construction Manager's project management responsibilities for the Work on each Project shall include the following activities unless expressly waived or changed in a Work Order:

(a) Preparing and circulating daily or weekly written updates of the progress of the Work and benchmarked against the Construction Schedule and other requirements as specified in the Contract Documents, including, without limitation, current photographs of the progress of the Work, to City of Jonesville and Architect that shall be delivered by electronic mail or posted to a Project-specific website designated for the Project;

(b) Scheduling a progress meeting with City of Jonesville, Architect, and to the extent necessary for the proper or timely completion of the Work, City of Jonesville's Vendors at least weekly or such other time period if specified otherwise by the Contract Documents, and circulating minutes of the meeting for the foregoing parties' review, comment and approval within three (3) days after the meeting;

(c) Preparing and circulating monthly, and accompanying the Payment Application, a report that specifies any and all delays occurring or likely to occur to the Construction Schedule, including those arising from Uncontrolled Conditions and causes by Construction Manager, Construction Manager's Agents and third parties ("**Delay Report**"); and

(d) Properly staffing the Project, which expressly includes the obligation to maintain the Key Employees defined in Exhibit A as supplemented by the Work Order ("**Key Employees**") of a Project until Final Completion is achieved. Without limiting the foregoing and notwithstanding anything to the contrary, Construction Manager further agrees that the designated Superintendent shall remain fully engaged on the Project, and cannot be relocated to another project of Construction Manager until Final Completion has been achieved.

9. **Changes in Project; Work by City of Jonesville**.

9.1. During the course of the Work on a Project, City of Jonesville or Construction Manager may request changes in the Work ("**Change Order**"). Construction Manager shall not perform, and shall not be obligated to perform, any changes in the Work unless and until City of Jonesville (through City of Jonesville's Project Manager) and Construction Manager agree in writing to such changes, and any necessary extension of the Construction Schedule and adjustment in the Contract Sum. Neither Construction Manager nor Architect shall not have the right to authorize minor deviations in the Work.

9.2. City of Jonesville may, without invalidating this Agreement, unilaterally require changes in the Work or any component thereof at any time prior to the date of Substantial Completion. If Construction Manager does not agree to the change and issue a Change Order, City of Jonesville may unilaterally issue a Construction Change Directive ("**Construction Change Directive**").

9.3. If the Change Order or Construction Change Directive changes the Work for which an adjustment in the Contract Sum is warranted, the adjustment shall be based on City of Jonesville's and Construction Manager's agreement of a lump sum cost or some other formula mutually agreed upon by the Parties. If there is no mutual agreement, the Contract Sum shall be adjusted based on the actual cost of the construction services incurred or no longer required including services at the "**Hourly Rates**" for Construction Manager as set forth in **Exhibit A** and/or the Work Order, as applicable, plus the applicable Construction Manager's fee for overhead and profit as designated in the Work Order if applicable for the cost of such construction services added or deleted. If such change in the Work includes the Work of Construction Manager's Agents, the cumulative overhead and profit that may be charged by Construction Manager and Construction Manager's Agents of all tiers for the change shall not exceed fifteen percent (15%) of the cost of such construction services. In addition, unless otherwise agreed between the Parties, reasonable adjustments may need to be made in the Construction Schedule based on the Construction Change Directive. If City of

Jonesville and Construction Manager subsequently reach full agreement on the subject matter of the Construction Change Directive, it shall be converted into a Change Order.

9.4. **Audit**. Construction Manager shall, concurrently with performance the Work, prepare Records, as defined below, which substantiate the Work rendered. Construction Manager shall for all of Construction Manager's Work performed, retain all Records for three (3) years after the date of Final Completion of a Project or for any longer period of time as may be required by Applicable Laws or good construction practice. If Construction Manager receives notification of a dispute or the commencement of a Claim regarding a Project within this three (3) year period, Construction Manager shall continue to maintain all Records for such Project until final resolution of the Claim. Upon seven (7) days' written notice, Construction Manager shall make its Records available, as well as its employees available for interview, during normal business hours to City of Jonesville and its authorized representative(s) or designee(s). City of Jonesville and its authorized representative(s) or designee(s) shall be entitled to inspect, examine, review and copy Construction Manager's Records at City of Jonesville's reasonable expense within adequate work space at Construction Manager's office. Failure by Construction Manager to supply substantiating Records shall be reason to exclude the related costs from amounts which might otherwise be payable by City of Jonesville to Construction Manager pursuant to this Agreement. If an audit discloses overcharges (of any nature) of or to City of Jonesville by Construction Manager, Construction Manager shall immediately reimburse City of Jonesville for such overcharge paid by City of Jonesville. Interest shall begin to accrue at the Interest Rate if the overcharge is not paid within five (5) days after notice of the overcharge is provided to Construction Manager. "**Records**" are the records of Construction Manager and Construction Manager's Agents consisting of all information, materials and data of every kind and character, including, without limitation, records, books, papers, documents, subscriptions, recordings, agreements, purchase orders, work orders, leases, contracts, commitments, arrangements, notes, daily diaries, superintendent reports, manuals, drawings, specifications, receipts, vouchers and memoranda, and any and all other agreements, sources of information and matters that may in City of Jonesville's reasonable judgment have any material bearing on or pertain to any matters, rights, duties or obligations under or covered by this Agreement, or any Contract Documents. Such Records shall also include hard copy, as well as computer-readable data if it can be made available, and electronic documents, written policies and procedures, time sheets, payroll registers and records, cancelled checks, 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, invoice and related payment documentation, general ledger entries detailing cash and trade discounts earned, insurance rebates and dividends and any other Construction Manager's records which may have a bearing on matters of interest to City of Jonesville to the extent necessary to adequately permit evaluation and verification of compliance with (a) the requirements of this Agreement, (b) City of Jonesville's business ethics policies and (c) provisions for pricing Change Orders, Construction Change Directives, Payment Applications, and Claims.

10. **Insurance; Bonds; Indemnity**.

10.1. Construction Manager shall procure and keep in effect during the period in which it performs any Work on or for a Project commercial general liability, automobile liability, and property damage insurance with respect to the Project and Construction Manager's use and occupancy thereof, protecting City of Jonesville and Construction Manager from all causes, including their own negligence, naming City of Jonesville and its lender each as an additional insured party (as evidenced below) and having minimum limits of liability as provided in **Exhibit B** attached to this Agreement ("**Insurance Requirements**"). Construction Manager also agrees to carry employer's liability insurance, and workers' disability compensation insurance, in such amounts as set forth on **Exhibit B**. Construction Manager shall be responsible at its sole expense to pay any deductibles. All insurance obtained by Construction Manager shall be obtained from reputable companies in good standing under the laws of the State of Michigan, and all liability policies shall contain clauses that the insurer will not cancel or change the insurance without first giving City of Jonesville fifteen (15) days prior written notice. Construction Manager shall comply with all terms, conditions and agreements contained in all such policies. If Construction Manager fails to obtain any insurance required by this Section, City of Jonesville, at its option, may obtain the same for Construction Manager and deduct the cost thereof from any payments to be made by City of Jonesville under this Agreement. Certificates of insurance fully-executed, and, if requested by City of Jonesville, certified copies of policies of insurance, acceptable to City of Jonesville, together with the additional insured endorsement, evidencing the required insurance policies, minimum coverages, and other required insurance details in this Agreement shall be filed with City of Jonesville within ten (10) days after the execution of this Agreement and prior to the commencement of any Work. Construction Manager's insurance is primary to any insurance maintained by City of Jonesville, as City of Jonesville's insurance is considered excess, contingent and non-contributory. The amount of Construction Manager's and Construction Manager's Agents' insurer's liability under its respective insurance policy shall not be reduced by the existence of such other insurance

carried by City of Jonesville. With respect to Construction Manager's and Construction Manager's Agents' liability policies, they shall provide for cross-liability or severability of interest clause. City of Jonesville must approve Construction Manager's insurance companies and forms, and all insurances companies shall maintain at all times a rating of an A- or higher by A.M. Best. Each policy of Construction Manager and Construction Manager's Agents shall include a waiver of subrogation and Construction Manager hereby waives, and shall cause Construction Manager's Agents to waive, all rights against City of Jonesville for damages caused by fire or other causes of loss to the extent covered or required herein to be covered by insurance.

10.2. Upon request by City of Jonesville pursuant to a Work Order, Construction Manager shall furnish bonds covering its faithful performance of this Agreement and the payment obligations arising under this Agreement for the benefit of City of Jonesville and/or a warranty bond expiring six (6) months after expiration of the Correction Period. The cost of the bonds will be included in the Contract Sum of a Project. Each Construction Manager bond shall cover the entire Contract Sum and required Subcontractor bonds cover the entire price for the Subcontractor's Work. Bonds shall be executed by a responsible surety licensed in the State of Michigan with an A.M. Best's rating of an A, XII or better. The payment and performance bonds shall remain in effect for a period of not less than one (1) year following the later of (a) the Final Completion date, or (b) the time required to resolve any items of incomplete Work or the payment of any disputed amount. Each bond shall (x) display the surety's bond number, and (y) include a rider that expressly waives the surety's right to notice, waives any defense or rejection of a claim on the basis of a modification of any sort to the Work or this Agreement and requires the surety to remain obligated under such bond to any successor, grantee or assignee of City of Jonesville. Construction Manager shall be solely responsible for all communications to the surety, and City of Jonesville shall be included in all such communications, but City of Jonesville shall have the right to communicate directly with the surety. All bonds shall be delivered to City of Jonesville before any Work is permitted to commence and at the same time that the insurance certificates or policies, as applicable, are delivered. If Construction Manager fails to obtain any bond required by this Section, City of Jonesville, at its option, may obtain the same for Construction Manager and any Subcontractors and deduct the cost thereof from any payments to be made by City of Jonesville under this Agreement.

10.3. Construction Manager shall indemnify, defend (using legal counsel selected by City of Jonesville) and hold City of Jonesville, City of Jonesville's representative, City of Jonesville's lender, and their principals, employees and agents harmless from any and all claims, losses, damages and liabilities arising therefrom including, without limitation, for injury or death to any person or damage or destruction to any property (including actual attorneys' fees) arising from or relating to the acts or omissions of Construction Manager and/or any Construction Manager's Agents, in the performance or non-performance of its duties under this Agreement and applicable Work Order or breach of this Agreement or applicable Work Order. If any party asserts a lien against City of Jonesville's Property as a result of services procured by, through, or at the direction of Construction Manager, or its Construction Manager's Agents, Construction Manager shall defend, indemnify, and hold City of Jonesville harmless from all damages, liability, losses, and costs, including actual attorney fees.

10.4. City of Jonesville shall be responsible for recording a notice of commencement and otherwise complying with the requirements imposed upon City of Jonesville under the Michigan Construction Lien Act. City of Jonesville will promptly provide Construction Manager with a copy of such notice of commencement and copies of any notices of furnishings or claims of liens City of Jonesville receives from any Construction Manager's Agents in connection with the Work for this Project.

11. **Licenses, Permits, Soils Test, Surveys and Utility Connections**. Construction Manager shall obtain all licenses, permits and approvals necessary for the completion of each Project as soon as reasonably possible during the course of development of the Project and in accordance with the Construction Schedule; provided, however, that Construction Manager shall not be required to obtain any licenses, permits or approval necessary for the installation by City of Jonesville of any equipment, fixtures or furnishing which are not specifically included in the Contract Documents. Further, Construction Manager shall be responsible for obtaining all additional surveys, soil tests, and utilities necessary for the construction and completion of the Project in accordance with this Agreement, as well as for extending to the Property or otherwise providing all utilities necessary or appropriate for the lawful and proper use of the Project. City of Jonesville shall not be responsible for payment of Construction Manager's costs associated with a delay in issuing a permit, license or utility connection contemplated by this section.

12. **Clean-Up**. As a condition precedent to Substantial Completion being achieved and thereafter as a condition to final payment and Final Completion, Construction Manager shall remove all waste materials and rubbish from the Property, as well as its tools, construction equipment, machinery, supplies and excess materials, and leave the Project (including the Work and the Property upon which the Work was performed) professionally cleaned in accordance with the Contract Documents. In

addition, during the period of construction, Construction Manager shall maintain the Property in a reasonably neat and clean condition. If Construction Manager shall fail to comply with this Section, City of Jonesville may perform such activities and charge the cost to Construction Manager, which amount shall be paid by Construction Manager within five (5) days of invoice or City of Jonesville, in its sole discretion, may deduct the amount owed from the Contract Sum. Interest shall accrue at the Interest Rate after the 5-day grace period until paid in full.

13. **Warranties**. Construction Manager represents and warrants to City of Jonesville on the Effective Date of the effective date of each Work Order, and during the term of each of the following, which are in addition to, and not in lieu of, any and all other liability imposed upon Construction Manager by Applicable Laws with respect to Construction Manager's duties, obligations and performance under this Agreement:

13.1. That Construction Manager and its Subcontractors are financially solvent, able to pay all debts as they mature, and possess the sufficient working capital to complete the Work and perform all obligations required by this Agreement;

13.2. That it is authorized to do business in the State of Michigan and properly licensed (when licensing is required) by all necessary governmental and public and quasi-public authorities having jurisdiction over it and over the Work and the Project pursuant to each Work Order;

13.3. That Construction Manager and its principals and employees has/have not been involved in any actions that excluded any parties from participation in any federally funded health care program, including, without limitation, Medicare and Medicaid;

13.4. That Construction Manager is responsible for all acts or omissions of its employees and all other persons working by or through Construction Manager on each Project;

13.5. That Construction Manager is entering into this Agreement and each Work Order as an arms-length transaction and is an independent Construction Manager;

13.6. That Construction Manager is properly licensed by the applicable authority to perform the Work, is authorized to do business in Michigan, and the person signing this Agreement and each Work Order on behalf of Construction Manager is authorized to bind Construction Manager to the terms of this Agreement and each Work Order;

13.7. That it possesses a high level of experience and expertise in the business administration, construction, construction management and superintendence of projects of this size, complexity, and nature of each Project, and it will perform the Work with the care, skill and diligence of such a Construction Manager; and

13.8. That the Work, including all materials and equipment furnished under this Agreement and each Work Order, will be of good quality and new unless otherwise required or permitted by this Agreement or a Work Order for the Work, that the Work will be free from defects, will not violate the rights of third parties (including patent and copyright licenses), will comply with all performance standards and Applicable Laws, is fit for its intended purposes, and conforms to the requirements of this Agreement and each Work Order. Construction Manager agrees to perform all Work in such a manner so as to preserve any and all manufacturers' warranties, unless otherwise expressly directed by City of Jonesville in writing. If within one (1) year after the Final Completion date ("**Correction Period**"), any of the Work is found to be not in accordance with the requirements of this Agreement, Construction Manager shall correct it promptly at its expense after receipt of written notice from City of Jonesville to do so. At City of Jonesville's option, such correction may be to either repair or replace the Work. Upon completion of the correction, the one (1) year Correction Period warranting the Work shall begin anew with respect to any corrective Work. Between ninety (90) and sixty (60) days prior to the expiration of the Correction Period, Construction Manager shall perform a walk-through of the Project and identify any non-conforming Work that Construction Manager must correct as non-conforming Work prior to the expiration of the Correction Period. If Construction Manager shall fail to correct the Work, or commence and diligently pursue correction of the Work where the corrective Work is of a nature that customarily requires more than thirty (30) days to correct, within thirty (30) days after notice from City of Jonesville, City of Jonesville may perform the corrective Work and charge Construction Manager its costs of correction together with interest at the Interest Rate until paid in full. If Construction Manager shall fail to pay City of Jonesville for such cost within thirty (30) days after City of Jonesville delivers an invoice for payment, City of Jonesville may pursue any and all remedies permitted by law or in equity. In addition, if there are amounts due and owing from City of Jonesville

to Construction Manager under this Agreement or any other agreement, City of Jonesville may deduct its costs from payments then or thereafter due Construction Manager for City of Jonesville's costs of such correction. Notwithstanding anything to the contrary, the Correction Period is in addition to the manufacturers' warranties and other warranties required or given under this Agreement or the Contract Documents and is not a limitation to such warranties.

14. **Environmental Matters**. If Construction Manager or Construction Manager's Agents shall encounter at the Property any hazardous material or substance, Construction Manager shall, upon recognizing the condition, immediately stop the Work in the affected area and report the condition to City of Jonesville in writing, as well as take such reasonable precautions to avoid further danger to people and the Project from such hazardous material or substance and protect the Work from any damage or destruction caused by stopping Construction Manager's services. Construction Manager shall be wholly responsible for the presence of any hazardous material or substance that is caused by the acts or omissions of Construction Manager or Construction Manager's Agents and shall be responsible for any damage caused by Construction Manager's failure to either immediately report the condition to City of Jonesville or resulting from Construction Manager's failure to take reasonable precautions as required above. In such case, Construction Manager shall reimburse City of Jonesville for all costs and expenses incurred by City of Jonesville, including administrative expenses, court costs, remediation expenses and actual attorney fees, to render the material or substance harmless, pay for injury or death of the persons, and correct the damage to Work caused thereby. The hazardous material or substance is considered "**rendered harmless**" when such hazardous material or substance is at a level that does not exceed the applicable exposure standards permitted by Applicable Laws.

15. **Dispute Resolution.** If there shall occur any dispute, controversy or claim between or among the Parties regarding the breach, interpretation or enforcement of this Agreement, a Work Order, or otherwise relating to a Project (in each case a "**dispute**"), the dispute shall be exclusively resolved in the following manner:

15.1. If a dispute shall arise between Construction Manager and City of Jonesville, as the first step in resolving such dispute, the dispute shall be submitted to the other Party's Project Manager. In the event that the dispute has not been timely resolved by the Project Managers, Construction Manager and City of Jonesville shall each appoint a senior representative with decision-making authority to meet for the purpose of resolving such dispute. The meeting shall take place within fourteen (14) days of written request to the other Party to negotiate with senior representatives.

15.2. If after seven (7) days of negotiation the dispute is not resolved, the dispute shall be referred to non-binding facilitative mediation. The request for mediation shall be filed in writing with the other Party to this Agreement, and may be made concurrently with the filing of a demand for arbitration. But, in such event, mediation shall proceed in advance thereof and arbitration shall be stayed pending mediation.

15.3. The mediation shall be conducted by a mediator agreeable to City of Jonesville and Construction Manager. In the absence of an agreement on a mediator within fourteen (14) days of the date the request for mediation is filed with the other Party, the mediator shall be named by the American Arbitration Association ("**AAA**") within seven (7) days thereafter. The mediation shall occur within thirty (30) days from the date the mediator is selected. Only upon the mutual agreement of Construction Manager and City of Jonesville may the 30-day period for mediation be extended for another fourteen (14) days. The Parties shall equally share the mediator's fee and any filing fees. The mediation shall be held in the place where the Project is located, in a location selected by the mediator, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

15.4. Disputes which have not been resolved by mediation shall become subject to arbitration which, unless the parties mutually agree otherwise, shall be in accordance with the Construction Industry Arbitration Rules of the AAA currently in effect at the time of the arbitration except that the Parties shall be entitled to engage in full discovery in the arbitration proceeding as permitted by the Federal Rules of Civil Procedure. The demand for arbitration shall be filed in writing with the other Party to this Agreement and with the AAA. The arbitration shall be conducted in Grand Rapids, Michigan using construction industry arbitrators from West Michigan.

15.5. A demand for arbitration may be made no earlier than concurrently with the filing of a request for mediation, but in no event more than thirty (30) days after expiration of the time period for mediation set forth above, nor shall it be made after the date when institution of legal or equitable proceedings based on such dispute would be barred by the applicable statute of limitations as determined by Applicable Laws, except as provided above during the period of mediation.

15.6. An arbitration pursuant to this Agreement may be joined with an arbitration involving common issues of law or fact between City of Jonesville, Construction Manager, any of Construction Manager's Agents, City of Jonesville's Vendors, and/or any consultants of City of Jonesville, including without limitation, the Architect. All Subcontracts shall mandate participation in dispute resolution by consolidation and joinder. The Party filing a notice of demand for arbitration must assert in the demand all disputes then known to that Party on which arbitration is permitted or to be demanded.

15.7. The award rendered by the arbitrator(s) shall be final, and judgment may be entered upon it in accordance with Applicable Laws in any court in Michigan having jurisdiction thereof. The award rendered by the arbitrator(s) shall explain the basis for the award and disclose the arbitrator(s)' determination of the percentage of fault of each party to the arbitration. Each such Party shall be financially responsible for its percentage of fault attributed to it in the award; provided, however, Construction Manager shall remain responsible financially for Construction Manager's Agents. Attorneys' fees and expenses shall only be recovered by a Party as determined by the arbitrator(s).

16. **Default and Termination**.

16.1. In the event of a default by either Party under this Agreement including a Work Order, the non-defaulting Party shall have the right to terminate this Agreement or the applicable Work Order, in its sole discretion, without prejudice to any other remedy upon not less than ten (10) days' prior written notice to the defaulting Party at its address stated above. However, such right to terminate shall only be effective if such default is not cured within the 10-day period or a reasonable time thereafter if the default cannot reasonably be cured within such time period and the defaulting Party is diligently working in good faith to cure the default. In the event of an uncured default, the non-defaulting Party shall have the right, with or without terminating this Agreement and the Work Orders, to pursue all remedies available under this Agreement and permitted by law or in equity, including recovery of damages and specific performance. In any such proceeding, the prevailing Party shall be entitled to recover its costs and reasonable attorneys' fees.

16.2. City of Jonesville may, at any time upon seven (7) days' notice or other time period specified in the notice to Construction Manager, terminate this Agreement and/or any Work Order in whole or in part for City of Jonesville's convenience and without cause, in which case, City of Jonesville shall only be responsible for paying Construction Manager for Work that was properly completed prior to City of Jonesville's date for termination in its notice in such terminated Work Orders, and there shall be no penalty or other right to collect additional sums from City of Jonesville by Construction Manager.

16.3. In the event of a termination of this Agreement and/or any Work Order prior to Final Completion for any reason, Construction Manager shall use reasonable efforts consistent with industry standards to secure all Work from vandalism and damage and not commit waste on the Property.

17. **Assignment**. Neither Party may assign this Agreement without the prior written consent of the other Party, which consent may be withheld in such Party's sole discretion except that City of Jonesville may assign this Agreement, collaterally or otherwise, to a lender of the Project.

18. **General**.

18.1. Enforceability. If any provision of this Agreement is unenforceable in whole or in part, such provision shall be limited to the extent necessary to render the same valid, or shall be excised from this Agreement as circumstances require, and this Agreement shall be construed as if such provision had been incorporated in this Agreement as so limited, or as if such provision had not been included in this Agreement, as the case may be.

18.2. Law. This Agreement shall be governed by and construed under the laws of the State of Michigan.

18.3. Notices. All notices, approvals, consents and other communications, including, without limitation, any changes to the Work (collectively, "**Notices**") shall be in writing and must be delivered by one of the following: (i) hand delivered, (ii) electronic mail or (iii) recognized national overnight courier that tracks receipt of packages, such as Federal Express, to the following:

To City of Jonesville: **To Construction Manager:**

Jeff Gray
City Manager
265 E. Chicago Street
Jonesville, Michigan 49250
Phone: 517-849-2104

_____
_____
_____
Attention: _____
Email: _____

Notices shall only be effective upon receipt if hand delivered or sent by electronic mail or upon delivery or refusal if sent via recognized national overnight courier. If the electronic mail address is not working, notice shall be given in writing and either hand delivered or sent via recognized national overnight courier. In such case, notice shall then be deemed to have been given at the time of delivery or refusal of delivery.

18.4. Time is of the Essence. Time is of the essence in this Agreement and each Work Order.

18.5. Nouns and Pronouns. Nouns and pronouns will be deemed to refer to the masculine, feminine, neuter, singular and plural, as the identity of the person or persons, firm or corporation may in the context require.

18.6. Descriptive Headings. The headings to the sections and subsections of this Agreement are inserted for reference only and are not to be either taken as limiting or extending the provisions of this Agreement, or given any effect on the construction or interpretation of this Agreement.

18.7. Vague Terms. Each Party to this Agreement participated in the drafting, preparation and negotiation of this Agreement. Therefore, no one Party to this Agreement is or should be considered to be the drafter of this Agreement, and any rule of construction which favors or gives the benefit of any doubt, uncertainty or ambiguity over the interpretation of this Agreement to one Party over the other shall not be applicable, even if one Party caused this Agreement to be reduced to writing.

18.8. Include or Including. Whenever the words "include", "includes" and "including" are used in this Agreement, such words shall be deemed to be followed by the words "without limitation".

18.9. WAIVER OF TRIAL BY JURY. EACH PARTY VOLUNTARILY AND IRREVOCABLY WAIVES TRIAL BY JURY IN ANY DISPUTE, CLAIM, ACTION, SUIT OR LITIGATION BASED ON OR ARISING OUT OF THIS AGREEMENT, EVEN IF THE RIGHT TO A TRIAL BY JURY WOULD OTHERWISE BE PROTECTED BY APPLICABLE LAW.

18.10. Days. All references to days in this Agreement shall mean calendar days unless otherwise specified.

18.11. Counterparts. This Agreement may be executed in several counterparts, all of which together shall constitute one and the same document.

18.12. Electronic Delivery. This Agreement may be signed and delivered by facsimile, email of an image file, or other electronic means, in which case the Agreement as so delivered will be effective as if an original.

19. **Enforceability; Entire Agreement; Amendment; Consent**.

19.1. This Agreement shall inure to the benefit of, be binding upon, and be specifically enforceable by Construction Manager and City of Jonesville, and their respective heirs, personal representatives, successors and assigns. This Agreement together with Work Orders contains all of the representations and statements by each Party to the other and expresses the entire understanding between the Parties with respect to each Project. All prior written and verbal communications, agreements and understandings concerning a Project are merged into and replaced by this Agreement.

19.2. Whenever City of Jonesville's consent or approval is required under this Agreement, such consent or approval shall be effective only if given in writing by City of Jonesville's Project Manager.

This Construction Management Agreement has been entered into by the Parties on the date first written above.

CONSTRUCTION MANAGER

By _____

Its _____

CITY OF JONESVILLE

By _____

Its _____

14254193-2

Exhibit A

Key Employees and Hourly Rates which may be supplemented by Work Orders

Employee	Name	Hourly Rate
Project Manager:	See Section 3.2 of the Agreement	[$___ or Not Applicable]
Superintendent	_____	$_____
[Insert others]		

Exhibit B

Insurance

Type of Insurance Coverage	**Minimum Limits of Liability**	**Additional Requirement**
Workers' Compensation	State and Federal Acts-Statutory	
Employers Liability including an "all states endorsement"	Employer's Liability-$500,000 for each occurrence	
Commercial General Liability including coverage for Independent Construction Managers, together with Product Liability and completed Operations (extending for at least thirty-six (36) months after completion of operations), Blanket or Broad Form Contractual, Personal Injury Liability, Broad Form Property Damage, Incidental Malpractice, Host Liquor Liability, and Independent Construction Managers, and Blanket XCU	$2,000,000-General Aggregate $2,000,000-Products-Comps/Ops Aggregate $1,000,000-Personal and Advertising Injury $1,000,000-Each Occurrence	Any additional exclusions not contained in the underlying general liability policy must be disclosed to and approved by City of Jonesville
Commercial Automobile Liability including coverage for owned, non-owned, and hired vehicles	$1,000,000-Combined Single Limit	
Umbrella / Excess Liability with following form coverage	$5,000,000 Each Occurrence and Aggregate (City of Jonesville may increase this at City of Jonesville's expense for higher exposures)	
"All risk" Property Insurance on personal property of Construction Manager and Construction Manager's Agents	Full replacement value	
Protective Liability Coverage (if Construction Manager or Construction Managers' Agents provide licensed architectural or engineering services as part of its Work)	$2,000,000 per occurrence for bodily injury and/or property damage	

Each policy of insurance shall be an occurrence policy (except as provided above). In addition, if the Work involves any of the following exposures, then Construction Manager shall purchase and maintain insurance of the types and with respective limits not less than the minimum amounts set forth below.

Type of Coverage	**Limits of Liability**
Explosion, Collapse and Undermining Coverage (if excavating, blasting, tunneling, etc.)	$ n/a per occurrence for bodily injury and/or property damage
Protective Liability Coverage (if Construction Manager uses subArchitects)	$ 0 per occurrence for bodily injury and/or property damage
Pollution Legal Liability (with the exclusion for professional errors and omissions deleted or a combined pollution and professional errors and omissions policy where there are both exposures for the Project)	$ n/a Each Occurrence and Aggregate (Construction Manager may raise amount at Construction Manager's expense for higher exposures)
Watercraft Hull and Protection and Indemnity Liability including coverage for owned, non-owned, and hired crafts	Value of hull and $ n/a (Protection and Indemnity) Bodily Injury and Property Damage
Aircraft Hull and Liability including coverage for owned, non-owned and hired crafts	$ n/a Combined Single Limit (Bodily Injury and Property Damage) to include Passenger Liability without any seat limitations
Federal Employee Liability Act, U.S. Longshoremen and Harbor Workers, Jones Act	State and Federal Acts-Statutory: $ n/a
Builder's Risk	$ 0

City of Jonesville reserves the right to require Construction Manager to obtain additional insurance coverages and endorsements at City of Jonesville's sole discretion and expense, according to the nature and location of Work to be performed by Construction Manager.

If the Work involves any professional liability errors and omissions exposures, then Construction Manager shall purchase and maintain insurance of the types and with respective limits not less than the minimum amounts set forth below.

PART 1 - GENERAL

1.01 LAWS AND REGULATIONS:

A. Notice and Compliance: All laws, ordinances, rules and regulations which are applicable to the Work.

B. Variance: When the specifications or drawings are in variance to the laws and regulations, the CONTRACTOR shall promptly serve written notice to the ENGINEER. Any alterations will be made by modification.

C. When work is performed contrary to laws and regulations, without notice to the ENGINEER, all costs will be borne by the CONTRACTOR.

1.02 PERMITS:

A. Drawings and specifications for the building will be filed, and the building permit will be obtained and paid for by the OWNER. All temporary permits shall be obtained and, with all inspection fees, shall be paid for by the CONTRACTOR for the respective work requiring such permits.

B. Permanent permits and licenses necessary for the work will be obtained by the OWNER.

C. Permits for welding, flame cutting or any construction method using flame shall be obtained by the CONTRACTOR from the OWNER.

1.03 TAXES:

A. Sales, consumer, use and other similar taxes required for the work shall be paid by the CONTRACTOR.

1.04 USE OF PREMISES:

A. Confine work operations to the construction site and the designated areas. All areas shall be restored to equal to or better than original condition.

B. Storage areas shall have no unreasonable encumberment with materials and equipment.

1.05 ORAL ORDER:

A. No oral order intended to affect or modify any of the terms or obligations in the Contract Documents shall be considered valid unless given to the CONTRACTOR in the presence of the ENGINEER and such oral order shall be documented by the ENGINEER in writing with a copy to the OWNER within twenty-four (24) hours of the time first given.

1.06 LABOR, MATERIALS AND EQUIPMENT:

A. CONTRACTOR shall provide competent, suitably qualified personnel to lay out the work and perform construction as required by the Contract Documents. He shall at all times maintain good discipline and order at the site. ENGINEER may judge the competency and qualifications of personnel and, upon his written request to the CONTRACTOR, cause the immediate dismissal from the Work of any incompetent and unqualified personnel.

B. CONTRACTOR shall guarantee that he has available the quantities and quality of labor and supervision necessary to fulfill the contractual obligations beyond any union manpower pool.

C. CONTRACTOR shall furnish all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, and all other facilities and incidentals necessary for the execution, testing initial operation, and completion of the Work.

1.07 OWNER FURNISHED PRODUCTS:

A. CONTRACTOR'S Responsibilities:
1. Designate the delivery for each product in the Construction Schedule.
2. Review the Shop Drawings, Product Data and Samples.
   a. Submit to ENGINEER with notification of any discrepancies or problems anticipated in the use of the product.
3. Receive and unload the products at the site:
4. Promptly inspect products jointly with the OWNER, record shortages, and damaged or defective items.
5. Handle products at the site, including uncrating and storage.
6. Protect the products from exposure to the elements and from damage.
7. Assemble, install, connect, and adjust the products as stipulated in the respective Section of the Specifications.
8. Repair or replace items damaged by the CONTRACTOR.

B. OWNER'S Responsibilities:
1. Arrange for and deliver the necessary Shop Drawings, Product Data, and samples to the CONTRACTOR.
2. Arrange and pay for delivery of the product to the site in accordance with the Construction Schedule.
3. Deliver supplier's bill of materials to the CONTRACTOR.
4. Inspect deliveries jointly with the CONTRACTOR.
5. Submit claims for transportation damage.

1.08 COORDINATION:

A. Utilities: Notify "Miss Dig" (800-482-7171) a minimum of 48 hours prior to start of work to allow all utilities to locate their facilities.

B. Restricted Work Times: Shall be as follows, except in emergency:
1. Sunday work will be permitted when coordinated with the OWNER.
2. Night work will be permitted from 4:30 p.m. to 7:00 a.m. when coordinated with the OWNER.

C. Unsuccessful Inspection:
1. When inspection readiness is declared by the CONTRACTOR and the inspection proves unsuccessful, all costs for the inspection shall be borne by the CONTRACTOR.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY:

A. Administrative and procedural requirements governing handling and processing of Allowances.

B. Selected materials and equipment and, in some cases, their installation is shown and specified in the Contract Documents by Allowances. Allowances have been established instead of additional requirements and to defer selection of actual materials and equipment to later date when additional information is available for evaluation. Additional requirements, if necessary, will be issued by Change Order.

1.02 ALLOWANCES:

A. It is intended that the work covered by these Cash Allowances will be done within this Contract under the supervision of the General Contractor and/or Subcontractors. All outside expenses, overhead and profit connected with the work contemplated in these Allowances shall be included in the Contract Base Bid Price. No mark-up for the General Contractor or Subcontractors shall be included in such Change Order, unless the Allowance is exceeded. In the event of overrun of the Allowance, a total mark-up of 5% will be permitted on the difference between the stated Allowances and the final price. In the event of an underrun of the Allowance, the difference, including outside expenses, overhead and profit, will be deducted from the Contract Price by Change Order.

B. Types of Allowances required include the following: N/A.

1.03 CONTINGENCY ALLOWANCES:

A. Use the Contingency Allowance only as directed for the OWNER's purposes, and only by Change Orders which designate amounts to be charged to the Allowance.

B. The CONTRACTOR's related costs for products or equipment ordered by the OWNER under the Contingency Allowance, including delivery, installation, taxes, insurance, equipment rental, and similar costs are not part of the Contract Base Bid Price.

C. Change Orders authorizing use of funds from the Contingency Allowance will include the CONTRACTOR's related costs and reasonable overhead and profit margins.

D. At Project closeout, credit unused amounts remaining in the Contingency Allowance to OWNER by Change Order.

1.04 SELECTION AND PURCHASE:

A. At the earliest feasible date after Contract award, CONTRACTOR shall advise the ARCHITECT/ENGINEER of the date when the final selection and purchase of each product or system described by an Allowance must be completed in order to avoid delay in performance of the work.

B. When requested by the ARCHITECT/ENGINEER, CONTRACTOR shall obtain proposals for each Allowance for use in making final selections; include recommendations that are relevant to performance of the work.

C. CONTRACTOR shall purchase products and systems as selected by the ARCHITECT/ENGINEER from designated supplier.

1.05 SUBMITTALS:

A. CONTRACTOR shall submit under the provisions of SECTION 01300 - Submittals.

B. Proposals for installation and purchase of products or systems included in Allowances.

C. Invoices or delivery slips to indicate actual quantities of materials delivered to the site for use in fulfillment of each allowance.

1.06 UNUSED MATERIALS:

A. CONTRACTOR shall return unused materials to the manufacturer or supplier for credit to the OWNER, after installation has been completed and accepted.

B. Where it is not economically feasible to return unused material for credit and when requested by the ARCHITECT/ENGINEER, prepare unused material for the OWNER's storage, and deliver to the OWNER's storage space as directed. Otherwise, disposal of excess material is the CONTRACTOR's responsibility.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

3.01 INSPECTION:

A. CONTRACTOR shall inspect products covered by an Allowance promptly upon delivery for damage or defects.

3.02 PREPARATION:

A. CONTRACTOR shall coordinate materials and their installation for each Allowance with related materials and installations to ensure that each Allowance item is completely integrated and interfaced with related construction activities.

END OF SECTION

PART 1 - GENERAL

1.01 PROJECT DESCRIPTION:

A. The work contained in this contract consists of the renovation of the laboratory at the Waste Water Treatment Plant, 150 Ecology Dr., Jonesville, Michigan, on the property owned by City of Jonesville as shown on the Contract Documents prepared by Century A&E, Inc., 277 Crahen Avenue N.E., Grand Rapids, Michigan 49525, dated May 10, 2021

1. All work will be performed in the City of Jonesville, Michigan.

B. As part of the scope of this work, the OWNER shall furnish the following equipment and materials. The CONTRACTOR shall provide materials lists and the labor to install the OWNER furnished equipment and materials and all other materials required to complete the work.

1. Loose furnishings and equipment.

C. As part of the scope of this work, the CONTRACTOR shall provide the required labor and materials to construct the following, as well as, all associated work required to complete the intent of the contract documents as described herein:

1. ARCHITECTURAL TRADES:
   a. Architectural demolition
   b. General trades
   c. Membrane roofing
   d. Sealants, & Caulking
   e. Painting
   f. Vinyl tile flooring and base
   g. Laboratory Furnishings.

4. PLUMBING TRADES:
   a. Sanitary drain, waste, and vent systems.
   b. Domestic hot and cold-water systems including all required insulation, hangers and supports.
   c. Plumbing fixtures including floor drains, emergency eyewash unit, and sinks.
   d. Pipe insulation including where indicated.
   e. Pipe and equipment labels.
   f. Commissioning and Owner Training.

5. MECHANICAL TRADES:
   a. Natural gas piping including pressure regulators, valves, supports, and connections to all gas-fired equipment. All natural gas piping is to be painted yellow. See Section 23 01 00 for details.
   b. Laboratory HVAC System
      1.) Packaged Rooftop Unit with curb.
      2.) Exhaust fan.
      3.) Supply, return and exhaust ductwork.
      4.) Air inlets and outlets.
      5.) Misc louvers and dampers.
      6.) Duct insulation.
      7.) DDC controls.
      8.) Test and balance.
   c. HVAC Temperature Controls Systems
      1.) Temperature and pressure sensors, low voltage wiring, and conduit.
   d. Equipment and pipe labeling
   e. Commissioning and Owner Training

1.) Complete functional tests of HVAC systems including demonstration to Owner and Engineer.
2.) Owner training on HVAC systems operations and maintenance requirements.

6. ELECTRICAL TRADES
   a. Electrical branch wiring and wiring devices for receptacles, HVAC fans, unit heaters, pumps, heaters, etc.
   b. Electrical power feeds to all HVAC and plumbing equipment (Fans, RTUs, MAUs, etc.)

D. Electrical enclosure and conduit systems shall be installed to meet requirements. Seal-offs will be installed throughout as required to meet the National Electrical Code.

E. The CONTRACTOR shall visit the site of the work and shall completely inform himself relative to construction hazards and procedure, labor, and all other conditions and factors, local and otherwise, which would affect execution and completion of the work and its cost. Such considerations shall include the arrangement and condition of the existing structures and facilities, the availability and cost of labor and facilities for transportation, handling and storage of materials and equipment. All such factors shall be properly investigated and considered in the preparation of the CONTRACTOR's proposal. There will be no subsequent financial adjustment for lack of such prior information.

F. There shall be no smoking at any time on the premises.

G. The Contractor shall not enter other areas of the existing buildings unless specifically required for the work to be performed. Portable toilet facilities shall be provided by the Contractor.

H. As part of the scope of work of this contract, the CONTRACTOR shall provide the required labor and materials to construct the new warehouse project and the associated work required to complete the intent of the contract documents as described herein.

1.02 SECTION INCLUDES:

A. COORDINATION WITH OTHER CONTRACTS.

B. CONTRACTOR USE OF SITE AND PREMISES.

C. WORK SEQUENCE AND SCHEDULE.

D. UTILITY INTERFACE.

E. OWNER OCCUPANCY.

1.03 COORDINATION WITH OTHER CONTRACTS:

A. All work will require coordination between the CONTRACTOR, the OWNER and the OWNER's CONTRACTORS especially related to installation of the packaging and process related equipment and systems.

1.04 CONTRACTOR USE OF SITE AND PREMISES:

A. Limit use of site and premises to allow:
   1. OWNER occupancy and operations.
   2. Work by others.

B. Access to Site:
   1. During construction all roadways, streets and alleys noted as fire lanes may not be

obstructed for more than 2 hours unless special permission is received from OWNER.

2. Contracted personnel are to check in each day with the main office unless otherwise directed by the Owner.

C. Emergency Building Exits During Construction: Do not obstruct.

D. Construction Operations: Limited to the immediate work area.

E. Utility Outages and Shutdowns: To be scheduled and coordinated with the OWNER and utility provider ahead of time.

1.05 WORK SEQUENCE AND SCHEDULE:

A. The CONTRACTOR shall proceed with the work such that the work is substantially complete by December 17, 2021.

B. The CONTRACTOR shall execute the work schedule based on the milestone events established in the construction schedule.

1.06 UTILITY INTERFACE:

A. Temporary power will be provided by the owner.

1.07 OWNER OCCUPANCY:

A. The OWNER will occupy the site during the entire period of construction for the conduct of normal operations. Any safety precautions required of the OWNER as a result of this work shall be clearly communicated to the OWNER prior to the start of any work.

B. Cooperate with OWNER to minimize conflict, and to facilitate OWNER's operations.

C. Schedule the Work to accommodate this requirement.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

1.02 DEFINITIONS:

A. Bulletin:
1. Change Orders will generally be preceded by issuance of Bulletins.
2. Bulletins are documents, written and/or graphic, which describe proposed Changes in the Work and which are issued to the CONTRACTOR for the purpose of obtaining a proposal for change(s) of Contract Price and/or Contract Time should such proposed Change in the Work be authorized by Change Order.
3. CONTRACTOR shall submit his proposal on or before due date stated on the Bulletin. If no due date is stated, it shall be 2 weeks (14 calendar days) following date of issue.

B. Change Order:
1. A Change Order is a written order issued to the CONTRACTOR authorizing an addition, deletion or revision in the Work, or an adjustment in the Contract Price or the Contract Time issued after execution of the Agreement.

C. Construction Change Directive:
1. A Construction Change Directive is a written order prepared by the ENGINEER and signed by the OWNER directing a change in the Work and stating a proposed basis for adjustment, if any, in the Contract Price or Contract Time, or both. The OWNER may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Price and Contract Time being adjusted according.
2. A Construction Change Directive shall be used in the absence of total agreement on the terms of the Change Order.

D. MINOR CHANGES IN THE WORK:

E. Supplemental instructions authorizing minor changes in the Work, not involving an adjustment to the Contract Price or Contract Time, will be issued by the ENGINEER as a Bulletin, Part I directive.

1.03 CHANGE ORDER PROPOSAL REQUESTS:

A. OWNER-Initiated Proposal Requests: Proposed changes in the Work that will require adjustment to the Contract Price or Contract Time will be issued by the ENGINEER, as a Bulletin, Part II directive with detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
1. Proposal requests issued by the ENGINEER are for information only. Do not consider them an instruction either to stop work in progress, or to execute the proposed change.

B. Unless otherwise indicated in the proposal request, within 14 days of receipt of the proposal request, submit to the ENGINEER for review an estimate of cost necessary to execute the proposed change.
1. Include list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
2. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
3. Include statement indicating the effect the proposed change in the Work will have on the Contract Time.

C. CONTRACTOR-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions require modifications to the Contract, the CONTRACTOR may propose changes by submitting request for change to the ENGINEER.
   1. Include statement outlining the reasons for the change and the effect of the change on the Work. Provide complete description of the proposed change. Indicate the effect of the proposed change on the Contract Price and Contract Time.
   2. Include list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

D. Any claim for an increase in the Contract Price or Contract Time shall be based on written notice delivered to ENGINEER within seven (7) days of the occurrence of the event giving rise to the claim. Notice of the amount of the claim with supporting data shall be delivered within fifteen (14) days of such occurrence unless ENGINEER allows an additional period of time to ascertain accurate cost data.

1.04 CONSTRUCTION CHANGE DIRECTIVE:

A. Construction Change Directive: When the OWNER and CONTRACTOR are not in total agreement on the terms of Change Order Proposal Request, the ENGINEER may issue Construction Change Directive instructing the CONTRACTOR to proceed with change in the Work, for subsequent inclusion in a Change Order.
   1. The Construction Change Directive will contain complete description of the change in the Work and designate the method to be followed to determine change in the Contract Price or Contract Time.

B. Documentation: Maintain detailed records on time and material basis of work required by the Construction Change Directive.
   1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.05 CHANGE ORDER PROCEDURES:

A. Upon the OWNER's approval of the Change Order Proposal Request, the ENGINEER will issue a Change Order for signatures of the OWNER and CONTRACTOR, as provided in the Conditions of the Contract.

B. Upon the CONSTRUCTION MANAGER's approval of the Change Order Proposal Request, the CONSTRUCTION MANAGER will issue the Change Order for signatures of the CONSTRUCTION MANAGER and the CONTRACTOR as provided in the Conditions of the Contract.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:
   1. Coordination.
   2. Administrative and supervisory personnel.
   3. General installation provisions.
   4. Cleaning and protection.
   5. Progress meetings, coordination meetings and pre-installation conferences are included in SECTION 00 31 19, Project Meetings.
   6. Requirements for the CONTRACTOR's Construction Schedule are included in SECTION 01 33 23, Submittals.

1.02 COORDINATION:

A. Coordination: Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.
   1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
   2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

B. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
   1. Prepare similar memoranda for the OWNER, ENGINEER and separate CONTRACTORS where coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

   1. Preparation of schedules.
   2. Installation and removal of temporary facilities.
   3. Delivery and processing of submittals.
   4. Progress meetings.
   5. Project Close-out activities.

1.03 SUBMITTALS:

A. Staff Names: Within 15 days of Notice to Proceed, submit list of the CONTRACTOR's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.
   1. Post copies of the list in the Project meeting room, the temporary field office, and near each temporary telephone.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION PROVISIONS:

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

E. Recheck measurements and dimensions, before starting each installation.

F. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

G. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

H. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the ENGINEER for final decision.

3.02 CLEANING AND PROTECTION:

A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading.
2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Thermal shock.
5. Excessively high or low humidity.

6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
9. Chemicals.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
18. Combustion.
19. Electrical current.
20. High speed operation,
21. Improper lubrication,
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Destructive testing.
25. Misalignment.
26. Excessive weathering.
27. Unprotected storage.
28. Improper shipping or handling.
29. Theft.
30. Vandalism.

END OF SECTION

PART 1- GENERAL

1.01 REQUIREMENTS INCLUDED:

A. The CONTRACTOR will schedule and administer the pre-construction meeting, periodic progress meetings and specially called meetings throughout the progress of the work.
   1. Prepare the agenda for the meetings.
   2. Distribute written notice of each meeting four (4) days in advance of meeting date.
   3. Make physical arrangements for meetings.
   4. Preside at meetings.
   5. Record the minutes; include significant proceedings and decisions.
   6. Reproduce and distribute copies within seven (7) days after each meeting.
      a. To participants in the meeting.
      b. To parties affected by decisions made at the meeting.

B. Representatives of contractor, subcontractors, and suppliers attending meetings shall be qualified and authorized at act on behalf of the entity each represents.

1.02 PRE-CONSTRUCTION MEETINGS:

A. Schedule: Meeting shall be prior to the start of work at a time and place designated by the OWNER.

B. Attendance:
   1. OWNER.
   2. ENGINEER.
   3. CONTRACTOR.
   4. Major Subcontractors.
   5. Utility companies.

C. Agenda:
   1. Responsibilities.
   2. General contract terms.
   3. Supervision.
   4. Schedules and seasonal limitations.
   5. Approvals and testing.
   6. Clearances and notices.
   7. Construction procedures.
   8. Payments and estimates.
   9. Labor requirements.

1.03 PROGRESS MEETINGS:

A. Schedule: Meetings will be scheduled a minimum of once each month at a time and place designated by the CONTRACTOR.

B. Attendance:
   1. ENGINEER.
   2. CONTRACTOR.
   3. Subcontractors as pertinent to agenda.

C. Agenda:
   1. Review and approve minutes of previous meeting.

2. Review of work progress since previous meeting.
3. Field observations, problems, conflicts.
4. Problems which impede constructing schedule.
5. Review of off-site fabrication and delivery schedules.
6. Corrective measures and procedures to regain projected schedule.
7. Revisions to construction schedule.
8. Progress schedule during the succeeding work period.
9. Coordination of schedules.
10. Review of submittal schedules.
11. Review of proposed changes for effect on construction schedule and on completion date.
12. Safety report.
13. Review new business.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Requests for relevant data to be furnished by the CONTRACTOR.

1.02 CONSTRUCTION SCHEDULES:

A. Form of Schedules:
1. Prepare schedules in the form of a horizontal bar chart.
2. Provide a separate horizontal bar for each trade or operation.
3. Provide a horizontal time scale identifying the first work day of each week.
4. The order shall be the chronological beginning of each work item.
5. The row identification shall be each major Specification Section or subdivision of work with distinct graphic delineation.

B. Content of Schedules: The construction project schedule shall include as a minimum:
1. Project start date.
2. Start dates and durations for each major trade group, work tasks or other subdivisions of the work.
3. Shop drawings, product data, and sample submittal dates and dates when reviewed copies will be required.
4. Equipment and/or material delivery dates if approved.
5. Total project duration and end date.

C. Updating:
1. The updated schedule shall indicate the following:
a. Reflect all changes since previous submission.
b. Indicate progress by identifying completed activities.
c. Major changes in scope.
d. Activities altered since previous submission.
2. Submit a narrative report, if required by ENGINEER defining:
a. Problem areas: Impact of current and anticipated delay factors.
b. Schedule changes: Effect on other contractors.
c. Revision description: Effect of change of scope and duration of activities.
3. Update schedule on a monthly basis.

D. Submittal of Schedule:
1. Within twenty-one (21) calendar days after receipt of notification of award of the contract. The CONTRACTOR shall submit to the ENGINEER for approval, an electronic copy of the Construction Schedule.
2. ENGINEER will review and return the approval copies within seven (7) days of the date of receipt. If corrections or revisions are required on the ENGINEER's approval copies, they shall be resubmitted within seven (7) calendar days of receipt of the review copy.
3. CONTRACTOR shall submit updated schedules, accurately depicting progress to the last working day of the previous month, on or before the fifth day of each month. CONTRACTOR shall distribute updated copies of the network plan to each concerned subcontractor.

E. Distribution: The reviewed schedule shall be distributed to:
1. ENGINEER
2. CONSTRUCTION MANAGER
3. OWNER

4. CONTRACTOR's job site file
5. Subcontractors

1.03 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES:

A. General: Where required by the Specifications, the CONTRACTOR shall submit descriptive information which will enable the ENGINEER to advise the OWNER whether the CONTRACTOR's proposed materials, equipment, or methods of work are in general conformance to the design concept and in compliance with the Drawings and Specifications. The information to be submitted shall consist of drawings, specifications, descriptive data, certificates, samples, test results and such other information, all as specifically required in the Specifications.

B. CONTRACTOR Responsibility:
1. CONTRACTOR shall be responsible for the accuracy and completeness of the information contained in each submittal and shall assure that the material, equipment or method of work shall be as described in the submittal. The CONTRACTOR shall verify that the material and equipment described in each submittal conform to the requirements of the Specifications and Drawings. If the information shows deviations from the Specifications or Drawings, the CONTRACTOR shall insure that there is no conflict with other submittals and notify the ENGINEER in each case where submittal may affect the work of another CONTRACTOR or the OWNER. The CONTRACTOR shall insure coordination of submittals among the related crafts and subcontractors.
2. The CONTRACTOR shall be responsible to check and verify all field measurements, all dimensions on shop and setting drawings and all schedules required for the work of all the various trades.
3. The CONTRACTOR may authorize in writing a material or equipment supplier to deal directly with the ENGINEER or with the OWNER with regard to a submittal. These dealings shall be limited to contract interpretations.
4. The CONTRACTOR shall stamp each submittal with stamp, initialed and signed, certifying to review of the submittal by the CONTRACTOR, verification of field measurements and compliance with Contract Documents.

C. Transmittal Procedure:
1. General:
   a. Submittals shall be submitted promptly in accordance with dates in proposals, approved schedules and in such sequence that there is no delay in the Work or the work of any other CONTRACTOR.
   b. Submittals regarding material and equipment shall be accompanied by the attached Transmittal Form identifying the equipment and any variations from these Specifications. A separate form shall be used for each specific item, class of material, equipment, and items specified in separate, discrete Sections, for which the submittal is required. Submittals for various items shall be made with a single form when the items taken together constitute a manufacturer's package or are so functionally related that expediency indicates checking or review of the group or package as a whole
   c. A unique number, sequentially arranged, shall be noted on the transmittal form accompanying each item's submittal. Original submittal numbers shall have the following format "XXX-Y; where "XXX is the originally assigned submittal number, and "Y" is a sequential letter assigned for resubmittals, i.e., A, B, or C being the 1st, 2nd and 3rd resubmittals, respectively. Submittal 25-B, for example, is the second resubmittal of submittal 25.
2. Deviation From Contract: If the CONTRACTOR proposed to provide material or equipment which does not conform to the Specifications and Drawings, he shall indicate

so under "deviations" on the transmittal form accompanying the submittal copies. CONTRACTOR shall prepare reason for a change, including cost differential, and request a change order to cover the deviations.

3. Submittal Completeness: Submittals which do not have all the information required to be submitted, including deviations, are not acceptable and will be returned without review.

D. Review Procedure:

1. When the contract documents require a submittal, the CONTRACTOR shall submit one electronic copy of all submittal data.
2. Unless otherwise specified, within (7) calendar days after receipt of the submittal, the ENGINEER shall review the submittal and return an electronic copy which carries the ENGINEER's stamp of approval. The returned submittal shall indicate one of the following actions:
   a. If the review indicates that the material, equipment or work method is in general conformance with the design concept and complies with the Drawings and Specifications, submittal copies will be marked "FURNISH AS SUBMITTED". In this event the CONTRACTOR may begin to implement the work method or incorporate the material or equipment covered by the submittal.
   b. If the review indicates limited corrections are required, submitted copies will be marked "FURNISH AS CORRECTED". The CONTRACTOR may begin implementing the work method by the submittal in accordance with the noted corrections. Where submittal information will be incorporated in O&M data, a corrected copy shall be provided.
   c. If the review reveals that the submittal is insufficient or contains incorrect data, submitted copies will be marked "REVISE AND RESUBMIT". Except at its own risk, the CONTRACTOR shall not undertake work covered by this submittal until it has been revised, resubmitted and returned marked either "FURNISH AS SUBMITTED" or "FURNISH AS CORRECTED".
   d. If the review indicates that the material, equipment or work method is not in general conformance with the Drawings and Specifications, copies of the submittal will be marked "REJECTED". Submittals with deviations which have not been identified clearly may be rejected. Except at its own risk the CONTRACTOR shall not undertake the work covered by such submittals until it has been revised, resubmitted and returned marked either "FURNISH AS SUBMITTED" or "FURNISH AS CORRECTED".
   e. If the review indicates that the material or equipment is not from an acceptable manufacturer, as indicated in the Specifications, copies of the submittal will be marked "SUBMIT SPECIFIED ITEM". Except as its own risk, the CONTRACTOR shall not undertake the work covered by such submittals until it has been revised, resubmitted and returned marked either FURNISH AS SUBMITTED" or "FURNISH AS CORRECTED".

E. Effect of Review of CONTRACTOR's Submittal:

1. Review of Drawings, methods of work, or information regarding materials or equipment the CONTRACTOR proposes to provide, shall not relieve the CONTRACTOR of its responsibility for errors therein and shall not be regarded as an assumption of risks or liabilities by the ENGINEER or the OWNER, or by an officer or employee thereof, and the CONTRACTOR shall have no claim under the contract on account of the failure, or partial failure, of the method of work, material, or equipment so reviewed.
2. A mark of "FURNISH AS SUBMITTED" or "FURNISH AS CORRECTED" shall mean that the OWNER has no objection to the CONTRACTOR, upon its own responsibility, using the plan or method of work proposed, or providing the materials or equipment proposed.

1.04 OPERATION AND MAINTENANCE DATA:

A. Requirements:
1. Compile product data on related information appropriate for OWNER'S operation and maintenance of products furnished.
2. Prepare data in the form of an instructional manual for use by OWNER'S personnel. Prepare five (5) copies or complete sets compiled, bound, and indexed.
3. Submittal of operation and maintenance manuals shall be prior to final payment request.

B. Required Submittals:
1. Refer to technical Specification Sections for required submittals.

1.05 RECORD DOCUMENTS:

A. Requirements:
1. The CONTRACTOR shall maintain on the construction site a minimum of one (1) complete set of contract documents amended by "RED LINE" or highlight inclusion to reflect the most immediate status methods, materials, and locations and routings of construction. Supplementary sketches shall be included, if necessary, to clearly indicate all work as constructed.
2. At conclusion of work, the CONTRACTOR shall submit to the ENGINEER one (1) complete amended record set of these site documents.
3. Submittal shall be prior to final payment.
4. Failure of the CONTRACTOR to maintain an up-to-date set of Record Drawings on the project site shall be reason to withhold payments.

END OF SECTION

SHOP DRAWING TRANSMITTAL FORM
SUBMIT TO:

Century A&E
277 Crahen Avenue NE
Grand Rapids, Michigan 49525-3459

ATTN: SHOP DRAWING COORDINATOR

Client: _____
Project Description: _____
Location: _____
Contract Number: _____

Transmittal Number: _____
Project Number: _____
Specification Section: _____
Deviation: _____

Para. No.	Description of Equipment	Manufacturer	Dwg. or Data No.	Action Taken

CONTRACTOR: _____ BY: _____

_____ DATE: _____

_____

- -

(THIS SPACE FOR ARCHITECT - ENGINEER)

The above drawings are returned with action as designated above in accordance with the following legend:

Furnish as Submitted	(FAS)
Furnish as Corrected	(FAC)
Revise and Resubmit	(R&R)
Rejected	(REJ)
Submit Specified Item	(SSI)
Not Reviewed	(NR)

Comments: _____
_____
_____
_____
_____

Century A&E, Inc.

BY: _____ DATE: _____
(Signature)

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Site Safety Requirements and Procedures.

1.02 REQUIREMENTS AND PROCEDURES:

A. The CONTRACTOR shall take all necessary precautions as may be required by laws and regulations and the Contract Documents for the protection of the OWNER's and other contractors' property, as well as adjacent property. By such provisions, the CONTRACTOR shall also protect all persons who may be on the premises or on adjacent areas affected by the CONTRACTOR's operations. The CONTRACTOR shall take measures to assure its personnel and all subcontractors' personnel under its jurisdiction observe applicable safety precautions while working on the OWNER's property.

B. The CONTRACTOR shall carry on the work in accordance with Safety and Health Regulations for Construction, promulgated by the Secretary of Labor under Section 107 of the Contract Work Hours and Safety Standards Act, as obtained from Labor Building, 14th and Constitution Avenue, NW, Washington, DC 20013.

C. The CONTRACTOR shall comply with the provisions of the Federal Occupational Safety and Health Act, and Michigan Occupational Safety and Health Act as amended.

D. The CONTRACTOR shall work in compliance with the Michigan Worker Right-To-Know Law. The CONTRACTOR will maintain a Material Safety Data Sheet (MSDS) file for CONTRACTOR supplied materials at the job site office. No materials shall be brought on site without receipt of a covering MSDS at least 2 days prior to its delivery. The CONTRACTOR shall further provide the ENGINEER documented proof that all of its employees have been instructed in accordance with this and all such statutes and/or regulations.

E. The CONTRACTOR shall also familiarize itself with the OWNER's safety requirements regarding the use of hard hats, safety glasses, work shoes, and proper protective clothing as required for its and its subcontractors' employees, while on OWNER's property, and shall enforce this rule. The CONTRACTOR shall allow its employees or subcontractors to view the OWNER's safety film before starting work and shall comply with the OWNER's safety code.

F. The CONTRACTOR shall familiarize itself with the Site Health and Safety Plan contained in Appendix A for construction procedure associated with this project.

G. Requests for deviations from the Site Health & Safety Plan will be approved only when the following conditions are met:
   1. The deviation is submitted in the format of a complete and comprehensive Site Health & Safety Plan which will be used at all times by the CONTRACTOR, its employees, and its subcontractors and their employees instead of the attached Site Health & Safety Plan.
   2. The deviation does not result in a violation of applicable regulations.
   3. The deviation does not result in a level of protection less stringent than the attached Site Health & Safety Plan.
   4. The request is accompanied by a certification from a Certified Industrial Hygienist attesting that the above conditions are met by the request
   5. The deviation does not result in an increase in project cost.
   6. The deviation will not be implemented until the request is approved. A reasonable time, typically one week, will be required to review the request.

1.03 HOT-WORK PERMIT PROCEDURES:

A. Purpose: This policy states in detail the steps required to issue Hot-Work Permits. The procedure applies to both OWNER'S personnel and to CONTRACTOR'S personnel.

B. Definitions:
1. Hot-Work: The term "hot -work" means hot riveting, welding, burning, open flame use, or other mechanical spark-producing operations or those operations resulting in high temperature surfaces. It also includes opening electrical systems which have the potential of arcing or otherwise igniting a flammable material.
2. Hot-Work Permit:
a. A Hot-Work Permit is defined as a written notice permitting hot-work operations issued by a person with assigned authority. The permit shall be posted in the area in which the hot-work is being performed.
b. A Type I Hot-Work Permit is used where welding, torch cutting or where other open flame operations are to be done. Issuance of Type I Hot-Work permits will require approval of the OWNER'S Regional Safety Engineer or designee.
c. A Type II Hot-Work Permit is used for spark or heat producing operations only.
3. Flammable/Combustible/Ignitable Material: Any material that can be ignited during the course of hot-work will be considered to be a flammable, combustible or ignitable material. It includes flammable gases and liquids, settled dust, paper, plastics and wood. Noncombustible materials, defined as not igniting when held at 1500 degrees F (816 degrees C) for 15 minutes, are excluded.

C. Cleaning: Cleaning is defined as the removal of flammable, combustible and ignitable materials from a vessel, an area, or a surface. It includes testing to verify the safety of the atmosphere and steps taken to shield, vent, or wet down those items that cannot be removed. The preventive actions to be taken should be recorded on the permit form.
1. Fire Watch: Shall be provided for the floor area extending up to 50 feet in all directions including floors above and below the location of hot-work. Fire extinguishers and fire hose shall be readily available during the fire watch period. The fire watch will remain in the general area, building, etc. for the Type II Hot-Work Permit.

D. Procedure:
1. All signatures must be in place before a Hot-Work Permit can be issued.
2. The CONTRACTOR shall notify the OWNER of the intended work to be performed. The OWNER will then initiate the HWP with all pertinent information as supplied by the CONTRACTOR.
3. The immediate work area will be checked for flammable vapor gas content using an MSA Model 260 Explosive Meter or its equivalent. Any reading will cause the permit to not be issued. This is a minimum requirement. Other checking may be necessary dependent on the situation at the time the permit is requested.
4. Hot-Work Permits must be displayed in the immediate work area.
5. Qualified Fire Watch must be posted. For a Type I permit one person must be stationed in the area of work with a fire extinguisher and one additional person must be in the general area where the Hot-Work is being performed. For a Type II Hot-Work Permit only one fire watch is required. The person must remain in the general area (within visual or voice contact). A fire extinguisher must be kept in the area of the hot-work.
6. No after completion fire watch is required on Type II permits. However, electricals must be removed before the fire watch is secured.
a. Hot-Work Permits outside and fifty or more feet from any flammable liquid storage tank may utilize contractor employees as the fire watch.

b. It is the responsibility of the CONTRACTOR to be sure the fire watch is qualified.

7. Failure to follow these procedures by contractors can mean dismissal from the OWNER's site.

1.04 CONFINED SPACE ENTRY PROCEDURES:

A. Purpose: To provide safe procedures for the entry of confined spaces.

B. Definitions:

1. Confined Space: A space which by design has limited openings for entry and exit, unfavorable natural ventilation and is not intended for permanent employee occupancy. Included in these are tanks, tunnels, process vessels, manholes, boilers, ventilation and exhaust ducts, large pipe lines, excavations, etc.
2. Safety Hazards: Hazards of confined spaces may include oxygen deficiency, explosive or flammable atmospheres, concentrations of toxic substances, and/or physical hazards.

C. Procedure:

1. When applicable the confined space will be purged and/or ventilated. This is necessary when the confined space has contained known flammable and/or toxic chemicals, or has an oxygen deficient atmosphere.
2. Before testing and entry, the confined space will be isolated electrically and/or mechanically. All incoming lines or energy sources will be blanked, disconnected or have the energy source supplying them locked out.
3. Tests will be performed to determine:
   a. Oxygen Level: Must be greater than or equal to 19.5% or positive pressure supplied air breathing apparatus must be used. The oxygen level must not exceed 23.5% or it is considered an oxygen enriched atmosphere and special procedures must be used. Continuous ventilation should be used where possible.
   b. Flammability and/or Explosive Level: All confined spaces that have any possibility of having contained a flammable or explosive material should be tested. The atmosphere should contain no more than 10% of the LFL or LEL. This should determine the lowest ventilation rate acceptable. If the reading is above 10% of the LFL or LEL, additional ventilation should be applied. If this is impossible the department manager and the Regional Safety Engineer should be notified.
   c. Toxic Substance Levels: All confined spaces that have any possibility of having contained a toxic material should be tested for that material prior to entry.
4. Anytime there is confined space entry there must be at least one observer who remains outside the confined space at all times. It is observer's responsibility to visually monitor the persons in the confined space and remain in continuous verbal contact. Deviations from using a life-line will require a second observer at the confined space at all times.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

PART 1 - GENERAL

1.01 DEFINITIONS:

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. Indicated: The term "indicated" refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

C. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the ENGINEER," "requested by the ENGINEER," and similar phrases.

D. Approve: The term "approved," where used in conjunction with the ENGINEER's action on the CONTRACTOR'S submittals, applications, and requests, is limited to the ENGINEER's duties and responsibilities as stated in the Conditions of the Contract.

E. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. Furnish: The term "furnish" is used to mean "supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations."

G. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."

H. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."

I. Installer: An "Installer" is the CONTRACTOR or an entity engaged by the CONTRACTOR, either as an employee, subcontractor, or sub-subcontractor of lower tier for performance of particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

J. The term "experienced," when used with the term "Installer," means having minimum of five previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of the authority having jurisdiction.

K. Trades: Use of titles such as "carpentry" is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

L. Assignment of Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in the operations to be performed. The specialists must be engaged for those activities, and assignments are requirements over which the CONTRACTOR has no choice or option. Nevertheless, the ultimate responsibility for fulfilling Contract requirements remains with the CONTRACTOR.

1. This requirement shall not be interpreted to conflict with enforcement of building codes and similar regulations governing the Work. It is also not intended to interfere with local trade union jurisdictional settlements and similar conventions.

M. Project Site is the space available to the CONTRACTOR for performance of construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

N. Testing Laboratories: "Testing laboratory" is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.02 SPECIFICATION FORMAT AND CONTENT EXPLANATION:

A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's (CSI) format and MASTERFORMAT numbering system.

B. Specification Content: This Specification uses certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:

1. Abbreviated Language: Language used in Specifications and other Contract Documents is the abbreviated type. Words and meanings shall be interpreted as appropriate. Words that are implied, but not stated shall be interpolated as the sense required. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and the context of the Contract Documents so indicates.
2. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the CONTRACTOR. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the CONTRACTOR, or by others when so noted.

1.03 GOVERNING REGULATIONS/AUTHORITIES:

A. The ENGINEER has contacted authorities having jurisdiction where necessary to obtain information necessary for preparation of Contract Documents. Contact authorities having jurisdiction directly for information and decisions having bearing on the Work.

B. Copies of Regulations: Obtain copies of the following regulations and retain at the Project Site, available for reference by parties who have reasonable need for such reference.

1.04 SUBMITTALS:

A. Permits, Licenses, and Certificates: For the OWNER's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

1.05 INDUSTRY STANDARDS:

A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made part of the Contract Documents by reference.

B. Publication Dates: Comply with the standard in effect as of the date of the Contract Documents.

C. Conflicting Requirements: Where compliance with two or more standards is specified, and the standards may establish different or conflicting requirements for minimum quantities or quality levels. Refer requirements that are different, but apparently equal, and uncertainties to the ENGINEER for decision before proceeding.

1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for the context of the requirements. Refer uncertainties to the ENGINEER for decision before proceeding.

D. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed for performance of required construction activity, the CONTRACTOR shall obtain copies directly from the publication source.

E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

END OF SECTION

1.	AAA	American Arbitration Association 140 W. 51st St. New York, NY 10020	Phone: FAX:	(212) 484-4000 (212) 765-4874
2.	ACI	American Concrete Institute 38800 Country Club Drive P.O. Box 9094 Farmington Hills, MI 48333	Phone: FAX:	(248) 848-3700 (248) 848-3701
3.	ACEC	American Consulting Engineers Council 1015 15th Street, NW Washington, DC 20005-26605	www.acec.org Phone: FAX:	(202) 347-7474 (202) 898-0068
4.	ACIL	American Council of Independent Laboratories 1725 K St., NW - Suite 412 Washington, DC 20006	Phone: FAX	(202) 887-5872 (202) 887-0021
5.	AI	Asphalt Institute Research Park Drive P.O. Box 14052 Lexington, KY 40512-4052	Phone: FAX:	(606) 288-4960 (606) 288-4999
6.	AIA	American Institute of Architects 1735 New York Ave., NW Washington, DC 20006-5292	Phone: FAX:	(800) 365-2724 (202) 626-7421
7.	ANSI	American National Standards Institute 11 West 42nd Street, 13th Floor New York, NY 10036 (Cust. Serv.)	Phone: FAX:	(212) 642-4900 (212) 302-1286
8.	ASTM	American Society for Testing and Materials 100 Barr Harbor Drive West Conshohocken, PA 19428-2959	Phone: FAX:	(610) 832-9500 (610) 832-9555
9.	AWS	American Welding Society 550 LeJeune Road, NW Miami, FL 33126	Phone: FAX:	(800) 443-9353 (305) 443-7559
10.	BOCA	Building Officials and Code Administrators International, Inc. 4051 W. Flossmoor Road Country Club Hills, IL 60478-5795	Phone: FAX:	(800) 323-1103 (708) 799-4981
11.	FM	Factory Mutual Research Organization 1151 Boston-Providence Turnpike P.O. Box 9102 Norwood, MA 02062	Phone: FAX:	(781) 762-4300 (781) 762-9375
12.	ICBO	International Conference of Building Officials Uniform Building Code (UBC) 5360 South Workman Mill Road Whittier, CA 90601-2298	Phone: FAX:	(800) 284-4406 (562) 699-4522

13.	ICEA	Insulated Cable Engineers Association, Inc.		
		P.O. Box 440	Phone:	(508) 394-4424
		South Yarmouth, MA 02664	FAX:	(508) 394-1194
14.	IEC	International Electrotechnical Commission (Available from ANSI)		
		1430 Broadway	Phone:	(212) 354-3300
		New York, NY 10018		
15.	IEEE	Institute of Electrical and Electronic Engineers		
		1828 L St. NW, Suite 1202	Phone:	(202) 785-0017
		Washington, DC 20036-5104	FAX:	(202) 785-0835
16.	IESNA	Illuminating Engineering Society of North America		
		120 Wall Street, 17th Floor	Phone:	(212) 248-5000
		New York, NY 10005-4001	FAX:	(212) 248-5017
17.	LPI	Lightning Protection Institute		
		3365 N. Arlington Heights Rd., Suite E	Phone:	(847) 577-7200
		Arlington Hts., IL 60004	FAX:	(847) 577-7276
18.	NAPA	National Asphalt Pavement Assoc.		
		NAPA Building		
		5100 Forbes Blvd.	Phone:	(301) 731-4748
		Lanham, MD 20706-4413	FAX:	(301) 731-4621
19.	NEC	National Electric Code (from NFPA)		
		One Batterymarch Park		
		P.O. Box 9101	Phone:	(800) 344-3555
		Quincy, MA 02269-9101	FAX:	(617) 770-0700
20.	NECA	National Electrical Contractors Assoc.		
		3 Bethesda Metro Center, Suite 1100	Phone:	(301) 657-3110
		Bethesda, MD 20814	FAX:	(301) 215-4500
21.	NEMA	National Electrical Manufacturers Assoc.		
		13100 North 17th St., NW, Suite 1846	Phone:	(703) 841-3200
		Rosslyn, VA 22209	FAX:	(703) 841-3300
22.	NFPA	National Fire Protection Assoc.		
		One Batterymarch Park		
		P.O. Box 9101	Phone:	(800) 344-3555
		Quincy, MA 02269-9101	FAX:	(617) 984-7057
23.	NSF	National Sanitation Foundation		
		789 Vicksboro Rd.		
		P.O. Box 130140	Phone:	(734) 769-8010
		Ann Arbor, MI 48105	FAX:	(734)
24.	PCA	Portland Cement Assoc.		
		5420 Old Orchard Road	Phone:	(847) 966-6200
		Skokie, IL 60077-1083	FAX:	(847) 966-8389

25.	PCI	Precast/Prestressed Concrete Institute 175 W. Jackson Blvd., Suite 1859 Chicago, IL 60604	Phone: FAX:	(312) 786-0300 (312) 786-0353
26.	UBC	Uniform Building Code (See ICBO)		
27.	UL	Underwriters Laboratories 333 Pfingsten Rd. Northbrook, IL 60062	Phone: FAX:	(847) 272-8800 (847) 272-8129

Federal Government Agencies: Names and titles of federal government standard or Specification producing agencies are often abbreviated. The following acronyms or abbreviations referenced in the Contract Documents indicate names of standard or Specification producing agencies of the federal government. Names and addresses are subject to change but are believed to be, but are not assured to be, accurate and up to date as of the date of the Contract Documents.

1.	CE	Corps of Engineers (U.S. Department of the Army) Chief of Engineers - Referral Washington, DC 20314	Phone:	(202) 272-0660
2.	CFR	Code of Federal Regulations N. Capitol St. between G and H St. NW Washington, DC 20402	Phone:	(202) 783-3238
3.	CPSC	Consumer Product Safety Commission 5401 Westbard Ave. Bethesda, MD 20816	Phone: FAX:	(800)-638-2772 (301) 504-0580
4.	CS	Commercial Standard (U.S. Department of Commerce) Government Printing Office Washington, DC 20402	Phone:	(202) 377-2000
5.	DOC	Department of Commerce 14th St. and Constitution Ave., NW Washington, DC 20230	Phone:	(202) 377-2000
6.	DOT	Department of Transportation 400 Seventh St., SW Washington, DC 20590	Phone:	(202) 366-4000
7.	EPA	Environmental Protection Agency 401 M St., SW Washington, DC 20460	Phone:	(202) 382-2090
8.	FAA	Federal Aviation Administration (U.S. Department of Transportation) 800 Independence Ave., SW Washington, DC 20591	Phone: FAX:	(202) 267-3111 (202) 267-5047

9.	FCC	Federal Communications Commission 1919 M St., NW Washington, DC 20554	Phone:	(202) 632-7000
10.	FHA	Federal Housing Administration (U.S. Department of Housing and Urban Development) Director, Manufactured Housing and Construction Standards Division 451 Seventh St., SW, Room 9158 Washington, DC 20410-1422	Phone: FAX:	(202) 708-1422 (202) 708-0299
11.	FS	Federal Specification (from GSA) Specifications Unit (WFSIS) 7th and D St., SW Washington, DC 20406	Phone:	(202) 708-9205
12.	NIST	National Institute of Standards and Technology (U.S. Department of Commerce) Building 820, Room 306 Gaithersburg, MD 20899-0001	Phone: FAX:	(301) 975-3690 (301) 948-1416
13.	OSHA	Occupational Safety and Health Administration (U.S. Department of Labor) P.O. Box 37535 Washington, DC 20213-7535	Phone: FAX:	(202) 219-4667 (202) 219-9266
14.	USDA	U.S. Department of Agriculture Independence Ave. between 12th and 14th Sts., SW Washington, DC 20250	Phone:	(202) 447-8732
15.	USPS	U.S. Postal Service 475 L'Enfant Plaza, SW Washington, DC 20260	Phone: FAX:	(202) 268-2000 (202) 268-5293

B. State Government Agencies: Names and titles of state government agencies indicate names of standard or Specification producing agencies of the state government. Names and addresses are subject to change but are believed to be, but are not assured to be, accurate and up to date as of the date of the Contract Documents.

State of Michigan Agencies:

1.	Michigan Department of Transportation (MDOT) State Transportation Building 425 W. Ottawa St. Lansing, MI 48909	Phone:	(517) 373-2090
2.	Department of Labor Wage Hour Administration 7150 Harris Drive Lansing, MI 48909	Phone:	(517) 322-1825

3. MIOSHA
   Safety Standards Division
   P.O. Box 30015
   Lansing, MI 48909 — Phone: (517) 322-1245

4. Department of Civil Rights
   Director of Contract Compliance
   State of Michigan Plaza Building
   1200 Sixth Street
   Detroit, MI 48226 — Phone: (313) 256-2650

5. Michigan Dept. of Consumer & Industry Services
   Office of Fire Safety
   Michigan State Police (G.R. Office) (616) 447-2693
   7150 Harris Road
   Lansing, MI 48913-0001 — Phone: (517) 322-1924

6. Michigan Dept. of Consumer & Industry Services
   Occupational Health Division
   7150 Harris Rd., P.O. Box 30649 — Phone (517) 322-1608
   Lansing, MI 48909-8149 — FAX: (517) 322-1505

District Offices - Michigan DNR, Hazardous Waste Division:

1. Grand Rapids District Office
   Michigan DNR, Hazardous Waste Division.
   6th Floor, State Office Building
   350 Ottawa Ave., NW
   Grand Rapids, MI 49503 — Phone: (616) 456-5071

2. Lansing District Office
   Michigan DNR, Hazardous Waste Division.
   7150 Harris Drive, P.O. Box 30028
   Lansing, MI 48909 — Phone: (517) 322-1687

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section specifies administrative and procedural requirements for cutting and patching of existing building finishes and structural, mechanical and electrical systems.

B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

C. Requirements of this Section apply to electrical installations. Refer to Division 26 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.02 SUBMITTALS:

A. Submit under the provisions of SECTION 01 33 23.

B. Cutting and Patching Proposal: Submit procedures for cutting and patching before proceeding. Submit proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
3. List products to be used and firms or entities that will perform Work.
4. Indicate dates when cutting and patching is to be performed.
5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
7. Approval by the ENGINEER to proceed with cutting and patching does not waive the ENGINEER'S right to later require complete removal and replacement of part of the Work found to be unsatisfactory.

1.03 QUALITY ASSURANCE:

A. Requirements for Structural Work: Do not cut and patch structural elements in manner that would reduce their load-carrying capacity or load-deflection ratio.

B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in manner that would, in the ENGINEER'S opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in visually unsatisfactory manner.

1.04 SEQUENCING AND SCHEDULING:

A. Coordinate cutting, patching, repairing, redecorating, and related work necessary for incorporating Work into existing or new construction. Cutting shall be done by subcontractor requiring same. Patching shall be done by finish trades subcontractor (masonry, gypsum board, painting, ceiling, concrete, flooring, etc.) as directed by CONTRACTOR.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

B. Before proceeding, meet at the site with parties involved in cutting and patching, including structural, mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.02 PREPARATION:

A. Temporary Support: Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated, until provisions have been made to bypass them.

3.03 PERFORMANCE:

A. General: Employ skilled workmen to perform cutting and patching. Whenever possible, employ original installer to perform cutting and patching for weather exposed and moisture resistant elements, and sight-exposed surfaces. Proceed with cutting and patching at the earliest feasible time and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.
   1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
   3. Cut through concrete and masonry using cutting machine such as carborundum saw or diamond core drill.
   4. Comply with requirements of applicable Sections of Division 2 where cutting and patching requires excavating and backfilling.

C. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

D. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
   1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
   2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in manner that will eliminate evidence of patching and refinishing.
   3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.
      a. Where patching occurs in smooth painted surface, extend final paint coat over entire unbroken containing the patch, after the patched area has received primer and second coat.
   4. Patch, repair or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.
   5. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

3.04 CLEANING:

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
   1. Inspection procedures.
   2. Project record document submittal.
   3. Operating and maintenance manual submittal.
   4. Submittal of warranties.
   5. Final cleaning.

B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 33.

1.02 SUBSTANTIAL COMPLETION:

A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
   1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and statement showing an accounting of changes to the Contract Sum.
      a. If 100 percent completion cannot be shown, include list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
   2. Advise OWNER of pending insurance change-over requirements from CONTRACTOR'S responsibility for coverage to OWNER'S responsibility.
   3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents just after completion of installation of each item of equipment to avoid possible delays at close-out time.
   4. Obtain and submit releases enabling the OWNER unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
   5. Deliver tools, spare parts, extra stock, and similar items.
   6. Complete start-up testing of systems, and instruction of the OWNER'S operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
   7. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

B. Inspection Procedures: On receipt of request for inspection, the ENGINEER will either proceed with inspection or advise the CONTRACTOR of unfilled requirements. The ENGINEER will prepare the Certificate of Substantial Completion following inspection or advise the CONTRACTOR of construction that must be completed or corrected before the certificate will be issued.
   1. The ENGINEER will repeat inspection when requested and assured that the Work has been substantially completed.
   2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.03 FINAL ACCEPTANCE:

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
   1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
   2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
   3. Submit certified copy of the ENGINEER'S final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the ENGINEER.
   4. Submit consent of surety to final payment.
   5. Submit final liquidated damages settlement statement.
   6. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Reinspection Procedure: The ENGINEER will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the ENGINEER.
   1. Upon completion of reinspection, the ENGINEER will prepare certificate of final acceptance, or advise the CONTRACTOR of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
   2. If necessary, reinspection will be repeated.

1.04 RECORD DOCUMENT SUBMITTALS:

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in secure, fire-resistive location; provide access to record documents for the ENGINEER'S reference during normal working hours.

B. Record Drawings: Maintain clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at later date.
   1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
   2. Mark new information that is important to the OWNER but was not shown on Contract Drawings or Shop Drawings.
   3. Note related Change Order numbers where applicable.
   4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.

1. Upon completion of the Work, submit record Specifications to the ENGINEER for the OWNER'S records.

D. Record Product Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.
1. Upon completion of mark-up, submit complete set of record Product Data to the ENGINEER for the OWNER'S records.

E. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the CONTRACTOR will meet at the site with the ENGINEER'S and the OWNER'S personnel to determine which of the submitted samples that have been maintained during progress of the Work are to be transmitted to the OWNER for record purposes. Comply with delivery to the OWNER'S sample storage area.

F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the ENGINEER for the OWNER'S records.

G. Maintenance Manuals: Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inch (50.8 mm), 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:
1. Emergency instructions.
2. Spare parts list.
3. Copies of warranties.
4. Wiring diagrams.
5. Recommended "turn around" cycles.
6. Inspection procedures.
7. Shop Drawings and Product Data.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

3.01 CLOSEOUT PROCEDURES:

A. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the OWNER'S personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include detailed review of the following items:
1. Maintenance manuals.
2. Record documents.
3. Spare parts and materials.
4. Tools.
5. Lubricants.

6. Fuels.
7. Identification systems.
8. Control sequences.
9. Hazards.
10. Cleaning.
11. Warranties and bonds.
12. Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating equipment, demonstrate the following procedures:
1. Start-up.
2. Shutdown.
3. Emergency operations.
4. Noise and vibration adjustments.
5. Safety procedures.
6. Economy and efficiency adjustments.
7. Effective energy utilization.

3.02 FINAL CLEANING:

A. Cleaning: Employ experienced workers for final cleaning. Clean each surface or unit to the condition expected in normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
a. Remove labels that are not permanent labels.
b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
c. Clean exposed exterior and interior hard-surfaced finishes to dust-free condition, free of stains, films and similar foreign substances.
d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean light fixtures and lamps.
e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to smooth even-textured surface.

C. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the OWNER'S property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in lawful manner.
1. Where extra materials of value remaining after completion of associated Work have become the OWNER'S property, arrange for disposition of these materials as directed.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section specifies administrative and procedural requirements for Project Record Documents.

B. Project Record Documents required include:
1. Marked-up copies of Contract Drawings.
2. Marked-up copies of Shop Drawings.
3. Newly prepared Drawings.
4. Marked-up copies of Specifications, addenda and Change Orders.
5. Marked-up Product Data submittals.
6. Record Samples.
7. Field records for variable and concealed conditions.
8. Record information on Work that is recorded only schematically.

C. Specific record copy requirements that expand requirements of this Section are included in the individual Sections of Divisions 2 through 33.

D. General project closeout requirements are included in Section 01 77 19, "Project Closeout."

E. General requirements for submittal of Project Record Documents are included in Section 01 33 23, "Submittals."

F. Maintenance of Documents and Samples: Store record documents and Samples in the field office apart from Contract Documents used for construction. Do not permit Project Record Documents to be used for construction purposes. Maintain record documents in good order, and in clean, dry, legible condition. Make documents and Samples available at all times for inspection by the ENGINEER.

1.02 RECORD DRAWINGS:

A. Mark-up Procedure: During the construction period, maintain set of blue-line or black-line white-prints of Contract Drawings and Shop Drawings for Project Record Document purposes.
1. Mark these Drawings to indicate the actual installation where the installation varies appreciably from the installation shown originally. Give particular attention to information on concealed elements which would be difficult to identify or measure and record later. Items required to be marked include but are not limited to:
2. Dimensional changes to the Drawings.
3. Revisions to details shown on the Drawings.
4. Locations and depths of underground utilities.
5. Revisions to routing of piping and conduits.
6. Revisions to electrical circuitry.
7. Actual equipment locations.
8. Locations of concealed internal utilities.
9. Changes made by Change Order.
10. Details not on original Contract Drawings.

B. Mark completely and accurately record prints of Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions. Where Shop Drawings are marked, show cross-reference on Contract Drawings location.
1. Mark record sets with red erasable colored pencil; use other colors to distinguish between changes for different categories of the Work at the same location.

2. Mark important additional information which was either shown schematically or omitted from original Drawings.
3. Note construction change directive numbers, alternate numbers, Change Order numbers and similar identification.
4. Responsibility for Mark-up: Where feasible, the individual or entity who obtained record data, whether the individual or entity is the installer, subcontractor, or similar entity, is required to prepare the mark-up on record Drawings.
5. Accurately record information in an understandable Drawing technique.
6. Record data as soon as possible after it has been obtained. In the case of concealed installations, record and check the mark-up prior to concealment.

C. At time of Substantial Completion, submit record Drawings to ENGINEER for OWNER's records. Organize into sets, bind and label sets for OWNER's continued use.

1.03 RECORD PRODUCT DATA:

A. During the construction period, maintain 1 copy of each Product Data submittal for Project Record Document purposes.
1. Mark Product Data to indicate the actual product installation where the installation varies substantially from that indicated in Product Data submitted. Include significant changes in the product delivered to the site, and changes in manufacturer's instructions and recommendations for installation.
2. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
3. Note related Change Orders and mark-up of record Drawings, where applicable.
4. Upon completion of mark-up, submit complete set of record Product Data to the ENGINEER for the OWNER's records.
5. Where record Product Data is required as part of maintenance manuals, submit marked-up Product Data as an insert in the manual, instead of submittal as record Product Data.
6. Each prime CONTRACTOR is responsible for mark-up and submittal of record Product Data for its own Work.

1.04 MAINTENANCE MANUAL SUBMITTAL:

A. When each construction activity that requires submittal of maintenance manuals is nominally complete, but before Substantial Completion, submit maintenance manuals specified.
1. Organize operating and maintenance manuals into suitable sets of manageable size.
2. Bind data into individual binders for each manual, properly identified on front and spine. For large manuals, provide an index sheet and thumb tabs for separate information categories.
3. Provide heavy-duty 3-ring vinyl-covered binders, 1-inch (25.4 mm) to 2-inch (50.8 mm) thick as required to contain information, sized for 8-1/2 inch (215.9 mm) by 11-inch (279.4 mm) paper with inside pockets or pocket folders for folded sheets.
4. In each maintenance manual include information specified in individual Specification Sections and the following:
5. Emergency instructions.
6. Spare parts list.
7. Copies of specific warranties.
   a. Wiring diagrams.
8. Recommended maintenance procedures and turn-around times.
9. Inspection and system-test procedures.
10. Copies of applicable Shop Drawings and Product Data.
11. Listing of required maintenance materials and services.

12. Names and addresses of sources of maintenance materials.
13. Maintenance Drawings and diagrams.
14. Precautions against improper maintenance and exposure.
15. Each prime CONTRACTOR is responsible for maintenance manuals for its own Work. Where manual includes information on installations by more than 1 Contract, the CONTRACTOR who is principal source of information, as designated by ENGINEER, shall receive information from other CONTRACTORS, coordinate and collate information for unified manual, and provide binders and submittal as specified.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

3.01 RECORDING:

A. Post changes and modifications to the Documents as they occur. Do not wait until the end of the Project. The ENGINEER will periodically review record documents to assure compliance with this requirement.

END OF SECTION

SECTION 02 41 19
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolition and removal of selected portions of building or structure.
   2. Salvage of existing items to be reused or recycled.

1.2 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
   1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.3 PREINSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at WWTP Building, 130 Ecology Dr., Jonesville, MI 49250.

1.4 INFORMATIONAL SUBMITTALS

A. Engineering Survey: Submit engineering survey of condition of building.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property for environmental protection, for dust control and for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of selective demolition activities with starting and ending dates for each activity.

D. Pre-demolition photographs or video.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

1.5 CLOSEOUT SUBMITTALS

A. Inventory of items that have been removed and salvaged.

1.6 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Owner will remove the following items:
   a. Owner's scientific laboratory equipment.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
1. Hazardous materials will be removed by Contractor before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Contractor as part of an allowance provided for in the contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
1. Maintain fire-protection facilities in service during selective demolition operations.

G. Arrange selective demolition schedule so as not to interfere with Owner's operations.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

C. Inventory and record the condition of items to be removed and salvaged.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
   1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
   2. Arrange to shut off utilities with utility companies.
   3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
   4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
      a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
      b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
      c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
      d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
      e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
      f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
      g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
   2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
4. Maintain fire watch during and for at least one hour after flame-cutting operations.
5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
6. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:
1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area [on-site] [off-site] [designated by Owner] [indicated on Drawings].
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition, cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 CLEANING

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.01 DESCRIPTION:

A. This Section includes the following:
1. Dimension lumber and boards.
2. Treated wood.
3. Wood grounds, nailers, and blocking.
4. Plywood Backing Panels.

1.02 RELATED SECTIONS:

A. The following contain requirements that relate to this Section:
1. Non-structural carpentry items exposed to view and not specified in another Section.

1.03 SUBMITTALS:

A. General: Submit the following in accordance with Section 01 33 23.

B. Product data for the following products:
1. Engineered wood products.

C. Material certificates for dimensional lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use as well as design values approved by the Board of Review of American Lumber Standards Committee.

D. Wood treatment data as follows including chemical treatment manufacturer's instructions for handling, storing, installation, and finishing of treated material:
1. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
2. For water-borne-treated products, include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to project site.
3. Warranty of chemical treatment manufacturer for each type of treatment.

1.04 QUALITY ASSURANCE:

A. Lumber Standards: Furnish lumber manufactured to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review. Lumber shall meet requirements of ASTM D1165.

B. Inspection Agencies: Inspection agencies and the abbreviations used to reference them with lumber grades and species include the following:
1. NLGA - National Lumber Grades Authority (Canadian).
2. SPIB - Southern Pine Inspection Bureau.
3. WWPA - Western Wood Products Association.

C. Grade Stamps: Provide lumber with each piece factory-marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

1. For exposed lumber, furnish pieces with grade stamps applied to ends or back of each piece; or omit grade stamps entirely and provide certificates of grade compliance issued by inspection agency.

D. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.
1. Provide dressed lumber, S4S, unless otherwise indicated.
2. Provide lumber with 15 percent maximum moisture content at time of dressing and shipment for sizes 2 inches or less in nominal thickness, unless otherwise indicated.

E. Single-Source Responsibility for Engineered Wood Products: Obtain each type of engineered wood products from one source, from single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces.

B. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.
1. For lumber and plywood pressure-treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.01 DIMENSION LUMBER:

A. Wood Stud Framing: Provide stud framing (2 to 4 inches thick, 2 to 4 inches wide, 10 feet and shorter) and other light framing (2 to 4 inches thick, 2 to 6 inches wide), any species, in following grade:
1. "Stud" grade.
2. "No. 3" grade.

2.01 BOARDS:

A. Where painted finish is indicated, provide "No. 1 Boards" per SPIB rules, or "No. 2 Common Boards and Better" per WWPA rules.

B. Concealed Boards: Where boards will be concealed by other work, provide lumber of 19 percent maximum moisture content (S-DRY or KD-19) and of following species and grade:

C. Board Sizes: Provide sizes indicated or, if not indicated, provide 1-inch by 8-inch boards.

2.03 MISCELLANEOUS LUMBER:

A. General: Provide lumber for support or attachment of other construction including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.

B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.

C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.

D. Grade: "Standard" grade light framing size lumber of any species or board-size lumber as required. "Standard" grade boards per WWPA rules or "No. 2 Boards" per SPIB rules.

2.04 PLYWOOD PANELS:

A. Plywood Panel Standards: Comply with PS 1 "US Product Standard for Construction and Industrial Plywood" for plywood construction panels and, for products not manufactured under PS 1 provisions, with APA PRP-108.

B. Trademark: Furnish plywood panels that are each factory-marked with APA trademark evidencing compliance with grade requirements.

C. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade designation, APA C-D PLUGGED EXPOSURE 1, in thickness indicated, or, if not otherwise indicated, not less than 15/32 inch.

2.05 FASTENERS:

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with minimum 1.25 oz (G-90) hot-dip zinc coating per ASTM A153 or of AISI Type 304 stainless steel.

B. Nails, Wire, Brads, and Staples: FS FF-N-105.

C. Power-Driven Fasteners: National Evaluation Report NER-272.

D. Wood Screws: ANSI B18.6.1.

E. Lag Bolts: ANSI B18.2.1.

F. Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and where indicated, flat washers.

2.06 PRESERVATIVE WOOD TREATMENT BY PRESSURE PROCESS:

A. General: Where lumber or plywood is indicated as preservative-treated wood or is specified herein to be treated, comply with applicable requirements of AWPA Standards C2 (Lumber) and C9 (Plywood). Mark each treated item with the AWPB or SPIB Quality Mark Requirements.

B. Pressure-treat above-ground items with water-borne preservatives to minimum retention of 0.25 pcf. For interior uses, after treatment, kiln-dry lumber and plywood to maximum moisture content, respectively, of 19 percent and 15 percent. Treat indicated items and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing. Treated wood used for roof blocking shall be kiln-dried after treatment and shall be stamped "KDAT".

C. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

D. Wood framing members less than 18 inches above grade.

E. Wood floor plates installed over concrete slabs directly in contact with earth.

F. Pressure-treat wood members in contact with the ground or fresh water with water-borne preservatives to minimum retention of 0.40 pcf.

G. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL:

A. Discard units of material with defects that impair quality of rough carpentry construction and that are too small to use in fabricating rough carpentry with minimum joints or optimum joint arrangement.

B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.

C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.

D. Securely-attach rough carpentry work to substrate by anchoring and fastening as indicated.

E. Countersink nail heads on exposed carpentry work and fill holes.

F. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

3.02 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS:

A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.

B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

END OF SECTION

SECTION 07 53 00
SINGLE-PLY MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Single-ply membrane roofing systems.
   1. Fully adhered fastened system.

B. Single ply roofing membranes include the following:
   1. EPDM- Tying into existing roofing membrane system for patching of existing roof openings being covered over and new roofing membrane for new roof openings tying into the existing roofing membrane system.

C. Roof insulation related to flexible sheet roofing.

1.2 RELATED SECTIONS:

A. Section 06 10 00 - Rough Carpentry.

1.3 SUBMITTALS:

A. Submit under provision of Section 01 33 23.

B. Product data, installation instructions, and general recommendations from manufacturer of single ply membrane system for types of roofing required. Include data substantiating that materials comply with requirements.
   1. If products will be supplied to the project exactly as specified, the CONTRACTOR may, at his option, submit a letter of certification listing products being supplied and identifying the manufacturer. Provided information is adequate to verify conformance with the specifications, a submittal is not required for product data, installation instructions, and general manufacturer recommendations.

C. Shop drawings showing roof configuration, sheet layout, seam locations, colors (as applicable), details at perimeter, and special conditions.
   1. Indicate layout of tapered insulation materials.
   2. Indicate layout and spacing of anchors required for conformance with Factory Mutual Classification.

D. Pre-roofing Conference records.

E. Test data for pullout resistance of fastening systems.

1.4 QUALITY ASSURANCE:

A. Manufacturer: Obtain primary flexible sheet roofing from a single manufacturer. Provide secondary materials as recommended by manufacturer of primary materials.

B. Installer: Engage an experienced Installer to apply single ply membrane roofing. Installer must be licensed by the manufacturer of primary roofing material and must have three (3) years minimum experience installing the specified manufacturer's product. Submit to the (CONSTRUCTION MANAGER) (ENGINEER), if requested, a list of successfully completed installations of the specified product.

1. Work associated with single ply membrane roofing, including (but not limited to) insulation, flashing and counterflashing, expansion joints, and joint sealers, is to be performed by Installer of this work.

C. Pre-Roofing Conference: Prior to installation of roofing and associated work, meet at project site, or other mutually agreed location, with Installer, roofing sheet manufacturer, installers of related work, and other entities concerned with roofing performance, including (where applicable) OWNER'S insurer, test agencies, governing authorities, (CONSTRUCTION MANAGER) (ENGINEER), and OWNER. Review project schedule, delivery requirements, unusual project conditions, roof traffic, and other issues essential for coordination of the work. Record discussions and agreements and furnish copy to each participant. Provide at least 72 hours' advance notice to participants prior to convening pre-roofing conference.

D. UL Listing: Provide labeled materials that have been tested and listed by UL in "Building Materials Directory" or by other nationally recognized testing laboratory for application indicated, with "Class A" rated materials/system for roof slopes shown.

E. Insulated Roof Assembly Ratings: Roof assemblies which do not have thermal barrier separation between metal deck and foam plastic insulation shall have successfully passed ANSI/UL 1256 and FM 4450 Calorimeter test procedures.

1.5 PROJECT CONDITIONS:

A. Weather Conditions: Proceed with roofing work when existing and forecasted weather conditions permit work to be performed in accordance with manufacturers' recommendations and warranty requirements.

B. Substrate Conditions: Do not begin roofing installation until substrates have been inspected and are determined to be in satisfactory condition.

C. Comply with requirements of NFPA 241 during installation of roofing.

1.6 WARRANTY:

A. Manufacturer's Warranty: Submit executed copy of single ply membrane manufacturer's "Limited Service Warranty" agreement including flashing endorsement, signed by an authorized representative of manufacturer. Provide form that was published with product literature as of date of Contract Documents, for the following period of time:
1. 15 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Compatibility: Provide products that are recommended by manufacturers to be fully compatible with indicated substrates or provide separation materials as required to eliminate contact between incompatible materials.

2.2 EPDM MEMBRANE:

A. General: Ethylene propylene diene monomers formed into uniform, flexible sheets, complying with ASTM D4637, Type 1.
1. Class U, unreinforced.

2. Class SR, Scrim or fabric internal reinforced.
3. Thickness: 60 mils, nominal.
4. Exposed Face Color: Black.

B. Method of Installation: Comply with NRCA Roofing and Waterproofing Manual, Specification Plate (46-1, IESL) (46-2, IESP) (46-3, IESF).
1. Fully adhered EPDM membrane (46-3, IESF).

C. Manufacturers subject to compliance with requirements of this Section, provide products of one of the following:
1. Carlisle Syntec Systems.
2. Firestone Building Products Co.
3. Versico, Inc., Subsidiary of Carlisle Corp.

2.3 AUXILIARY MATERIALS:

A. Sheet Seaming System: Manufacturer's standard materials for sealing lapped joints, including edge sealer to cover exposed spliced edges as recommended by membrane manufacturer.

B. Tapered Edge Strips, and Flashing Accessories: Types recommended by membrane manufacturer, including adhesive tapes, flashing cements, and sealants.

C. Flashing Material: Manufacturer's standard system compatible with flexible sheet membrane.

D. Wood Nailers: Pressure Treated lumber or plywood complying with applicable requirements of AWPA Standards C2 for lumber and C9 for plywood. Mark each treated item with the AWPB or SPIB Quality Mark requirements.
1. Pressure treat wood nailers with water-borne preservatives to minimum retention of 0.25 per cubic foot. For interior uses after treatment, kiln dry lumber and plywood to maximum moisture content of 19 percent and 15 percent respectively. Nailers shall be stamped KDAT (kiln dried after treatment).
2. Do all cutting and fabricating of treated items prior to treatment where possible. If cut after treatment, coat surfaces to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

E. Walkway Protection:
1. Rubber Walkway Pads: Rubber pad made by or approved by the roof system manufacturer.

F. Slip Sheet: Type recommended by membrane manufacturer for protecting membrane from incompatible substrates.

G. Mechanical Fasteners: Metal plates, caps, battens, accessory components, fastening devices, and adhesives to suit substrate and as recommended by membrane manufacturer.

H. Membrane Adhesive: As recommended by membrane manufacturer for particular substrate and project conditions, formulated to withstand min. 60-psf uplift force.

2.4 INSULATING MATERIALS:

A. General: Provide insulating materials to comply with requirements indicated for materials and in compliance with referenced standards in sizes to fit applications indicated, selected from

manufacturer's standard thicknesses, widths, and lengths. Furnish thicknesses indicated on Drawings.

1. Provide tapered board where indicated for sloping to drain. Fabricate with taper of 1/4 inch per foot, unless otherwise indicated.

B. Extruded Polystyrene Board Insulation: Rigid, cellular thermal insulation with closed cells and integral high-density skin, complying with ASTM C578 for Type indicated; with 5-year aged R-values of 5.4 and 5 at 40° and 75° F, respectively; and as follows:

1. Type IV, 1.6-per cubic foot min. density, 25 psi min. compressive resistance, unless otherwise indicated.
    a. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 10 and 200, respectively.
    b. Products: Subject to compliance with requirements, provide one of the following products:
        1) "AMOFOAM CM", Amoco Foam Products, Co.
        2) "FOAMULAR 250", UC Industries.
        3) "STYROFOAM SM or RM", Dow Chemical.

C. Molded Polystyrene Board Insulation: Rigid, cellular thermal insulation formed by the expansion of polystyrene resin beads or granules in a closed mold to comply with ASTM C578 for Type indicated and as follows:

1. Type IX, 1.80-per cubic foot min. density, aged r-value of 4.6 and 4.2 at 40 and 75° F, respectively.
    a. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 75 and 175, respectively.

D. Glass Fiber Board Roof Insulation: Thermal insulation produced by combining glass fibers with thermosetting resin binders and faced one side with asphalt and kraft paper to comply with ASTM C726; r-values of 2.8 to 12.5 depending on thickness at 75° F.

E. Polyisocyanurate Board Roof Insulation: Rigid, cellular thermal insulation with polyisocyanurate closed-cell foam core and manufacturer's standard facing laminated to both sides; complying with FS HH-I-1972/2, Class 1.

2.5 AUXILIARY INSULATION MATERIALS:

A. Adhesive for Bonding Insulation: Type recommended by insulation manufacturer and complying with fire resistance requirements.

B. Mastic Sealer: Type recommended by insulation manufacturer for bonding edge joints and filling voids.

C. Mechanical Anchors: Factory mutual approved, Corrosion-resistant type as recommended by insulation manufacturer for deck type and complying with fire and insurance uplift rating requirements.

1. Provide system tested and approved for I-60 wind uplift rating.

PART 3 - EXECUTION

3.1 PREPARATION OF SUBSTRATE:

A. General: Comply with manufacturers' instructions for preparation of substrate to receive single ply membrane system.

1. Verify that penetrations, expansion joints, and blocking are in placed and secured and that roof drains are properly clamped into position.

B. Clean substrate of dust, debris, and other substances detrimental to flexible sheet rubber system work. Remove sharp projections.

C. Install flashings and accessory items as shown, and as recommended by manufacturer if not shown.

D. Prime substrate where recommended by manufacturer of materials being installed.

E. Prevent compounds from entering and clogging drains and conductors and from spilling or migrating onto surfaces of other work.

3.2 INSULATION INSTALLATION:

A. General: Extend insulation full thickness in two layers, or in multiple layers over entire surface to be insulated, cutting, and fitting tightly around obstructions. Form cant strips, crickets, saddles, and tapered areas with additional material as shown and as required for proper drainage of membrane.
1. Stagger joints in one direction for each course. For multiple layers, stagger joints in both directions between courses with no gaps, to form a complete thermal envelope.
2. Lay insulation boards in parallel courses with long dimension of board perpendicular to continuous joints in deck and with joints in each course staggered with those of preceding course. Adjoining edges shall be brought to moderate contact, but not forced into place.
3. Assure that edges of insulation board are supported minimum of 1-1/2 inches (38.1 mm) on top flange of metal deck and not over ribs in accordance with Factory Mutual "Loss Prevention Data Sheet 1-28". Cut neatly around vertical surfaces, cant blocks, vent pipes, and roof curbs.
4. Roof insulation boards, which must be cut to fit roof dimensions, shall be cut so the smallest board dimension is as close to 50 percent of original board size as possible. This may be accomplished by cutting 6-inch sections off certain interior boards. Application shall be in strict compliance with manufacturer's instructions.

B. For unballasted roofing systems, all roof insulation must be totally mechanically fastened down to deck in addition to prescribed membrane fastening requirements. Each 4-foot (1219.2 mm) by 8-foot insulation board must have one screw and plate fastener not less than 6 inches from each corner with additional fasteners distributed throughout field of board in pattern as approved by F.M.

C. Do not install more insulation each day than can be covered with membrane before end of day or before start of inclement weather.

D. Secure roof insulation to substrate with mechanical anchors of type and spacing indicated but in no case provide less than one anchor per 4 square feet of surface area or less anchorage than required by FM "Loss Prevention Data Sheet 1-28."

3.3 MEMBRANE INSTALLATION:

A. General: Start installation only in presence of manufacturer's technical representative.
1. Cut out and repair membrane defects at end of each day's work.

B. Mechanically Fastened Membrane: Install membrane by unrolling over prepared substrate, lapping adjoining sheets as recommended by manufacturer, and bonding and sealing seams. Install mechanical fasteners at spacing recommended by manufacturer, covering with adhesive-applied membrane so no fasteners are exposed. Install flashings and counterflashings as shown or recommended by manufacturer.

1. Follow manufacturer's instructions for nonpenetrating mechanically fastened systems.

C. Walkway Protection:

1. Install paver units at locations shown and where required for access to roof-mounted equipment. Place protection boards carefully to avoid damage to membrane, laying over an additional layer of roof membrane material, loosely applied, for additional protection.
2. Adhere rubber walkway pads to roof membrane using manufacturer's recommended splicing tape. Space each pad minimum of 1-inch and maximum of 6 inches apart to allow for proper drainage. Follow manufacturer's instructions for installing walkway pads over field fabricated seams or within 3 inches of lap edges.

3.4 PROTECTION OF ROOFING:

A. Upon completion of roofing (including associated work), institute appropriate procedures for surveillance and protection of roofing during remainder of construction period. At end of construction period, or at a time when remaining construction will in no way affect or endanger roofing, make a final inspection of roofing and prepare a written report to OWNER, describing nature and extent of deterioration or damage found.

B. Repair or replace (as required) deteriorated or defective work found at time of final inspection to a condition free of damage and deterioration at time of Substantial Completion and in accordance with requirements of specified warranty.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Firestop all penetrations of floors and walls in fire-rated assemblies as indicated on Drawings. Only tested firestop systems shall be used in specific locations as follows:
   1. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
   2. Safing slot gaps between edge of floor slabs and curtain walls.
   3. Openings between structurally separated sections of walls or floors.
   4. Gaps between the top of walls and ceilings or roof assemblies.
   5. Expansion joints in walls and floors.
   6. Openings and penetrations in fire-rated partitions or walls containing fire doors.
   7. Openings around structural members that penetrate floors or walls.

1.02 RELATED WORK:

A. Coordinate Work of this Section with Work of other Sections as required to properly execute the Work and as necessary to maintain satisfactory progress of the Work of others Sections, including, but not necessarily limited to:
   1. Section 03300 - Cast-in-Place Concrete.
   2. Section 04200 - Unit Masonry.
   3. Section 07900 - Joint Sealers.
   4. Section 09250 - Gypsum Board.
   4. Section 23010 - Basic Materials and Methods - HVAC.
   5. Section 23070 - Mechanical Insulation.
   6. Section 22010 - Basic Materials and Methods - Plumbing.
   7. Section 26050 - Basic Materials and Methods - Electrical.

1.03 REFERENCES:

A. ASTM E814, "Standard Method of Fire Tests of Through Penetration Fire Stops."

B. ASTM E84, "Standard Test Method for Surface Burning Characteristics of Building Materials."

C. Underwriters Laboratories (UL) of Northbrook, IL also performs ASTM E814 tests under their designation of UL 1479, and publishes the results in their "Fire Resistance Directory" that is updated annually with a mid-year Supplement.
   1. UL Fire Resistance Directory:
      a. Through-Penetration Firestop Devices (XHCR).
      b. Fire-Resistance Ratings (BXUV).
      c. Through-Penetration Firestop Systems (XHEZ).
      d. Fill, Voids, or Cavity Material (XHHW).
      e. Forming Materials (XHKU).

D. UL 2079 "Tests for Resistance of Building Joint Systems."

E. Building Codes: MBC 2015, IBC 2015.

F. NFPA 101 "Life Safety Code."

G. NFPA 70 "National Electrical Code."

1.04 DEFINITIONS:

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, water, and hot gases through penetrations in fire-rated wall and floor assemblies.

B. F-Rating (Flame Rating): The length of time the firestop system will resist passage of gases and flame on the unexposed surface (opposite side of furnace) including penetrating elements. This rating assures the slow spread of the fire by preventing the passage of flame and gases within the project's fire resistance requirements.

C. T-Rating (Temperature Rating): The length of time the sample (including the penetrating element) does not exceed 325° F temperature rise above its initial temperature (approximately 400° F actual) as measured on the unexposed surface. This rating assures that the fire will not spread further by minimizing the temperature conductivity through the assembly, thus, preventing the ignition of combustible materials near or in contact with the assembly on the unexposed side of the fire within the project's fire resistance requirements. What good is a 2-hour rated floor (F-Rating) if the furnishings above the floor ignite (short circuit) within 1-hour; or if the unburned gases (smoke) above flash over (explode) within 1-hour?

1.05 SUBMITTALS:

A. Submit under provisions of Section 01 33 23 - Submittals.

B. Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used, and manufacturer's installation instructions to comply with Section 01300.

C. Manufacturer's Engineering Judgment Identification Number and drawing details when no UL system is available for an application. Manufacturer's Engineering Judgment must include both project name and CONTRACTOR'S name who will install firestop system as described on drawing.

D. Submit Material Safety Data Sheets (MSDS) provided with each product delivered to the job-site.

1.06 QUALITY ASSURANCE:

A. Furnish a manufacturer's direct representative (not distributor or agent) on the job-site during initial installation of firestop systems to train appropriate installing personnel in proper selection and installation procedures. Installation shall be done per manufacturer's written recommendations published in their literature and drawing details.

B. Firestop system installation must meet requirements of ASTM E814, UL 1479, or UL 2079 tested assemblies that provide a fire rating equal to that of the construction assembly being penetrated.

C. Proposed firestop materials and methods shall conform to applicable governing codes having jurisdiction.

D. Firestop systems do not re-establish the structural integrity of load bearing partitions or assemblies, nor support live loads and traffic. Installer shall consult the Structural Engineer prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no UL tested system is available through any manufacturer, a Manufacturer's Engineering Judgment derived from similar UL system designs or other tests must be submitted to local authorities having jurisdiction for review and approval prior to

installation. Manufacturer's Engineering Judgment drawings must follow requirements set forth by the International Firestop Council (September 7, 1994).

F. Installer Qualifications: Engage an experienced installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the CONTRACTOR or to an installer engaged by the CONTRACTOR does not in itself confer qualification on the buyer.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Delivery firestopping materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time a job-site.

C. Store materials under cover and protect from weather and other damage in compliance with manufacturer's requirements.

D. Comply with recommended procedures, precautions, or remedies described in Material Safety Data Sheets (MSDS) as applicable.

E. Do not use damaged or expired materials.

1.08 PROJECT CONDITIONS:

A. Do not use materials that contain flammable solvents.

B. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather Conditions: Do not proceed with installation of firestop materials when temperature exceeds the manufacturer's recommended limitations for installing materials printed on product label and product data information sheet.

E. During installation, provide masking and drop cloths to prevent firestopping from contaminating any adjacent surfaces not scheduled to be covered.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Provide firestopping composed of components that are compatible with each other, with the substrates forming openings, and with the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the manufacturer and approved by the qualified testing agency for the designated fire-resistance rated systems.

2.02 ACCEPTABLE MANUFACTURERS:

A. Subject to compliance with requirements of through penetration firestop systems listed in Volume II (XHEZ) of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:
1. 3M Fire Protection Products, St. Paul, MN 55144-1000; telephone 800/328-1687.
2. Hilti Construction Chemicals, Inc., Tulsa, OK 74121; telephone 800/879-8000.
3. International Protective Coatings (IPC), Oakhurst, NJ 07712; telephone 800/334-8796.
4. Johns Manville, Denver, CO 80217-5108; telephone 888/322-1129.
5. Nelson Electric Co., Inc., Tulsa, OK 74101; telephone 800/331-7325.
6. Specified Technologies, Inc., Somerville, NJ 08876; telephone 908/526-8000.
7. Tremco Sealants & Coatings, Beachwood, OH 44122; telephone 216/292-5000.

2.03 MATERIALS:

A. Use only firestop products that have been tested under ASTM E814, UL 1479, or UL 2079 for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. For penetrations by non-combustible items, including steel pipe, copper pipe, rigid steel conduit, and electrical metallic tubing (EMT), the following materials are acceptable:
1. Hilti FS 601 Elastomeric Firestop Sealant.
2. Hilti FS-ONE High Performance Intumescent Firestop Sealant.
3. 3M Firestop Sealant 2000.
4. 3M Fire Barrier Caulk CP25.
5. Tremco Tremstop Fyre-Sil Sealant.

C. For fire-rated construction joints and other gaps, the following materials are acceptable:
1. Hilti FS 601 Elastomeric Firestop Sealant.
2. Hilti FS 604 Self-Leveling Elastomeric Firestop Sealant.
3. 3M Firestop Sealant 2000.
4. Tremco Tremstop Fyre-Sil Sealant.

D. For penetrations by combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed flexible cable or cable bundles, and plastic pipe (closed piping systems), the following materials are acceptable:
1. Hilti FS-ONE High Performance Firestop Sealant.
2. Hilti CP 642 Firestop Jacket.
3. 3M Fire Barrier Caulk CP25.
4. 3M Fire Barrier FS-195 Wrap/Strip.
5. Tremco Tremstop WBM Intumescent Firestop Sealant.

E. For penetrations by plastic pipe (open piping systems), the following materials are acceptable:
1. Hilti CP 642 Firestop Jacket.
2. Hilti FS-ONE High Performance Firestop Sealant.
3. 3M Fire Barrier PPD Plastic Pipe Device.

F. For large size or complex penetrations made to accommodate cable trays, multiple steel and copper pipes, and electrical busways in raceways, the following materials are acceptable:
1. Hilti FS 635 Trowelable Firestop Compound.

2. Hilti FIREBLOCK.
3. 3M Firestop Foam 2001.
4. 3M Fire Barrier CS-195 Composite Sheet.
5. Tremco PS Pillow System.

G. For openings between structurally separate sections of wall and floors, and at top of walls, the following materials are acceptable:
1. Hilti FS 601 Elastomeric Firestop Sealant.
2. Hilti FS-ONE High Performance Firestop Sealant.
3. 3M Fire Barrier Caulk CP25.

H. Provide a firestop system with an "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.

I. Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction being penetrated.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
1. Verify that penetrations are properly sized and in suitable condition for application of materials.
2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may inhibit proper adhesion.
3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during, and after installation of firestopping.
5. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Regulatory Requirements: Install firestop materials in accordance with published "Through-Penetration Firestop Systems" in the UL Fire Resistance Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration materials.
1. Seal all holes or voids made by penetrations to ensure an air-tight and water-tight seal.
2. Consult with ENGINEER and Project Manager prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
3. Protect materials from damage on surfaces subjected to traffic or to future work by subsequent trades.

3.03 FIELD QUALITY CONTROL:

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas. Inspect the installed firestopping system at minimum of 3 random locations for each discipline (HVAC, plumbing, electrical) to verify that UL requirements have been met. Replace materials damaged or removed during such inspection.

1. Verify that the construction type is identical to the construction type specified under the UL Listing for the products used.
2. Verify that the fire rating for the installed firestopping system is equal to or greater than the constructed assembly.
3. Verify that the joints or penetrating items match those specified in the UL Listing for both type and size.
4. Verify that the size of the opening meets the minimum and maximum requirements of the UL Listing.
5. Verify that the annular space meets the minimum and maximum requirements of the UL Listing.
6. Verify that ceiling and wall joints and penetrations are firestopped on both sides. Floors are usually protected from the underside only unless otherwise shown in the UL Listing.

B. Keep areas of work accessible until inspection by applicable code enforcement authorities.

C. Perform patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.04 ADJUSTING AND CLEANING:

A. Remove equipment, materials, and debris after completion of work and leave area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints of excess firestop materials and soiling as work progresses.

END OF SECTION

SECTION 07 90 00
JOINT SEALERS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. This Section includes joint sealers for the following locations:
   1. Exterior Joints in Vertical Surfaces and Nontraffic Horizontal Surfaces:
      a. Control and expansion joints in cast-in-place concrete.
      b. Joints between architectural precast concrete units.
      c. Joints between different materials listed above.
      d. Perimeter joints between materials listed above and frames of doors and windows.
      e. Control and expansion joints in ceiling and overhead surfaces.
      f. Other joints as indicated.
   2. Exterior Joints in Horizontal Traffic Surfaces:
      a. Control, expansion, and isolation joints in cast-in-place concrete slabs for floors and paving.
      b. Joints between different materials listed above.
      c. Other joints as indicated.
   3. Interior Joints in Vertical Surfaces and Horizontal Nontraffic Surfaces:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints of exterior openings where indicated.
      c. Joints between tops of non-load-bearing unit masonry walls
      d. Tile control and expansion joints.
      e. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
      f. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
      g. Perimeter joints of toilet fixtures.
      h. Other joints as indicated.
   4. Interior Joints in Horizontal Traffic Surfaces:
      a. Control and expansion joints in cast-in-place concrete slabs.
      b. Control and expansion joints in tile flooring.

B. Other joints as indicated.

1.02 RELATED SECTIONS:

A. The following sections contain requirements that relate to this Section:
   1. Firestopping sealants are specified in Section 07840 - Firestopping.

1.03 SUBMITTALS:

A. Product Data from manufacturers for each joint sealer product required, including instructions for joint preparation and joint sealer application.

B. Samples for verification purposes of each type and color of joint sealer required. Install joint sealer samples in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealers.

1.04 QUALITY ASSURANCE:

A. Installer Qualifications: Engage an Installer who has successfully completed within the last 3 years at least 3 joint sealer applications similar in type and size to that of this Project.

B. Single Source Responsibility for Joint Sealer Materials: Obtain joint sealer materials from single manufacturer for each different product required.

C. Federal Standards: Comply with following Federal Specifications.
1. One-component products shall meet requirements of TT-S-00230C.
2. Two-component products shall meet requirements of TT-S-00227E.
3. Silicone products shall meet requirements of TT-S-1543A.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Deliver materials to Project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.06 PROJECT CONDITIONS:

A. Environmental Conditions: Do not proceed with installation of joint sealers under the following conditions:
1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturers.
2. When joint substrates are wet due to rain, frost, condensation, or other causes.

B. Joint Width Conditions: Do not proceed with installation of joint sealers where joint widths are less than allowed by joint sealer manufacturer for application indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealers until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Compatibility: Provide joint sealers, joint fillers, and other related materials that are compatible with each another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Colors: Provide color of exposed joint sealers indicated or, if not otherwise indicated, as selected by ARCHITECT-ENGINEER from manufacturer's standard colors.

2.02 ELASTOMERIC JOINT SEALANTS:

A. Exterior Lap Joint Sealant: One-Part Butyl or Polyisobutylene Sealant, non-drying, non-skinning, and non-curing: Type S, Grade NS, and Class 25.
1. Uses: A, and, as applicable to joint substrates indicated, O.
2. Products: Butyl Sealant as manufactured by Tremco, Inc.

B. Restroom & Tile Sealant: One-Part Mildew-Resistant Silicone Sealant: Type S, Grade NS, Class 25.
   1. Uses: M, A, and as applicable to nonporous joint substrates indicated, O.
   2. Products: "Tremsil 200", Tremco, Inc.
   3. Color: As selected by ARCHITECT-ENGINEER.

C. High Performance General Purpose Exterior Non-Traffic Sealant: One-Part Non-Sag Polyurethane Sealant, ASTM C920: Type S, Grade NS, and Class 25.
   1. Uses: M, G, A, and, as applicable to joint substrates indicated, O.
   2. Products: "Dymonic", Tremco, Inc.
   3. Color: As selected by ARCHITECT-ENGINEER.

D. General Purpose traffic Bearing Sealant: One-Part Non-Sag Polyurethane Sealant, ASTM C920: Grade P, Class 25.
   1. Uses: T, and, as applicable to joint substrates indicated, O.
   2. Products: "THC-900", Tremco, Inc.

2.03 LATEX JOINT SEALANTS:

A. Acrylic-Emulsion Sealant: Manufacturer's standard, one-part, non- sag, mildew-resistant, acrylic-emulsion sealant complying with ASTM C834, formulated to be paintable and recommended for exposed applications on interior locations involving joint movement of not more than plus or minus 5 percent.
   1. Products: "Tremco Acrylic Latex 834"; Tremco Inc.
   2. Color: As selected by ARCHITECT-ENGINEER.

2.04 MISCELLANEOUS JOINT SEALANTS:

A. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, non hardening, non skinning, non staining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.
   1. ASTM c920, Grade NS, Class 12 ½.
   2. Uses: M and A.
      a. Products: "Tremco Acoustical Sealant", Tremco, Inc.

2.05 COMPRESSION SEALS:

A. Pre compressed Foam Sealant: Manufacturer's standard preformed, pre compressed, impregnated open-cell foam sealant manufactured from high-density urethane foam impregnated with nondrying, water repellent agent; factory-produced in pre compressed sizes and in roll or stick form to fit joint widths indicated and to develop watertight and airtight seal when compressed to the degree specified by manufacturer; and complying with the following requirements:
   1. Properties: Permanently elastic, mildew-resistant, non-migratory, nonstaining, compatible with joint substrates and other joint sealers.
   2. Impregnating Agent: Manufacturer's standard.
   3. Density: Manufacturer's standard.
   4. Backing: Pressure sensitive adhesive, factory applied to one side, with protective wrapping.
   5. Products: Subject to compliance with requirements, provide one of the following:
      a. "Emseal"; Emseal Corp.
      b. "Emseal Colorseal"; Emseal Corp. (at exposed brick).
      c. "Emseal 25 V"; Emseal Corp. (at concealed block).

d. "Will-Seal 150"; Illbruck Corp.
e. "York-Seal 200"; York Manufacturing, Inc.
f. "Polytite Standard", Polytite Mfg. Corp.

B. Preformed Hollow Neoprene Gasket: Manufacturer's standard preformed polychloroprene elastomeric joint seal of the open-cell compression type complying with ASTM D2628 and with requirements indicated for size, profile, and cross-sectional design.
1. Manufacturer: Subject to compliance with requirements, provide preformed hollow neoprene gaskets of one of the following:
a. The D.S. Brown Co.
b. The Hydrozo/Jeene, Inc.
c. Watson-Bowman & Acme Corp.

2.06 JOINT SEALANT BACKING:

A. General: Provide sealant backings of material and type which are non-staining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, non waxing, non extruding strips of flexible, non gassing plastic foam of material indicated below; nonabsorbent to water and gas; and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
1. Open-cell polyurethane foam for cold-applied sealants only.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.07 MISCELLANEOUS MATERIALS:

A. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealer-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Provide non staining, chemical cleaners of type which are acceptable to manufacturers of sealants and sealant backing materials, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have detrimental effect on sealant adhesion or in-service performance.

C. Masking Tape: Provide non staining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.

2.08 JOINT FILLERS FOR CONCRETE PAVING:

A. General: Provide joint fillers of thickness and widths indicated.

B. Sponge Rubber Joint Filler: Preformed strips complying with ASTM D1752 for Type I.

C. Bituminous Fiber Joint Filler: Preformed strips of composition below, complying with ASTM D1751:
1. Asphalt saturated fiberboard.

D. Pourable Epoxy Joint Filler: Two-component, gray, pourable, self-leveling, flexibilized epoxy joint sealant, or equivalent 100 percent solids, minimum Shore D Hardness of 50.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. "MM-80"; Metzger/McGuire Company.
      b. "Masterfil CJ"; Master Builders.
      c. "Polytops 480"; Chem Masters Corporation.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine joints indicated to receive joint sealers, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealer performance. Do not proceed with installation of joint sealers until unsatisfactory conditions have been corrected.

3.02 PREPARATION:

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:
   1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; old joint sealers; oil; grease; waterproofing; water repellents; water; surface dirt; and frost.
   2. Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or combination of these methods to produce clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
   3. Remove laitance and form release agents from concrete.
   4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile; and other nonporous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior experience. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALERS:

A. General: Comply with joint sealer manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Latex Sealant Installation Standard: Comply with requirements of ASTM C790 for use of latex sealants.

D. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

E. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
   1. Install sealant backing of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability.
      a. Do not leave gaps between ends of backing.
      b. Do not stretch, twist, puncture, or tear backing.
      c. Remove absorbent backings which have become wet prior to sealant application and replace with dry material.
   2. Install bond breaker tape between sealants and backing, compression seals, or back of joints where adhesion of sealant to surfaces at back of joints would result in sealant failure.
   3. Install compressible seals serving as sealant backings to comply with requirements indicated above for backing.

F. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.

G. Tooling of Non-sag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

H. Provide concave joint configuration per Figure 5A in ASTM C1193, unless otherwise indicated.

I. Installation of Pre-compressed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and to comply with sealant manufacturer's directions for installation methods, materials, and tools which produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's recommendations.

J. Installation of Preformed Hollow Neoprene Gaskets: Install gaskets, with minimum number of end joints, in joint recesses with edges free of spalls and sides straight and parallel, both within tolerances specified by gasket manufacturer. Apply manufacturer's recommended adhesive to joint substrates immediately prior to installing gaskets. For straight sections provide gaskets in continuous lengths; where changes in direction occur, adhesively splice gasket together to provide watertight joint. Recess gasket below adjoining joint surfaces by 1/8-inch to 1/4-inch.

K. Installation of Pourable Epoxy Joint Filler:
   1. Joint Filler for Saw-cut Joints in Floor Slab: After concrete slab is saw-cut, clean out joint with air hose. Pour epoxy filler into slot and allow to cure properly according to manufacturer's instructions.

L. Seams between two dissimilar materials, i.e. finish cap on half wall between production and service area.
   1. Ceiling at wall line.

3.04 CLEANING:

A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

3.05 PROTECTION:

A. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.

END OF SECTION

SECTION 09 65 13
RESLILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Thermoset-rubber base.
2. Rubber molding accessories.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 THERMOSET-RUBBER BASE

A. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
1. Style and Location:
a. Style B, Cove: Provide in areas with resilient floor coverings.

B. Thickness: 0.125 inch.

C. Height: 4 inches.

D. Lengths: Coils in manufacturer's standard length.

E. Outside Corners: Preformed.

F. Inside Corners: Preformed.

2.02 RUBBER MOLDING ACCESSORY

A. Description: Rubber reducer strip for resilient floor covering.

2.03 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

3.01 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 materials are the same temperature as space where they are to be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.02 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, 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. Preformed Corners: Install preformed corners before installing straight pieces.

3.03 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.

3.04 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

SECTION 09 90 00
PAINTING

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes surface preparation, painting, and finishing of exposed interior and exterior items and surfaces.
   1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified under other Sections.

B. Paint exposed surfaces whether or not colors are designated in "schedules," except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the ARCHITECT-ENGINEER will select from standard colors or finishes available.

C. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts, and labels.
   1. Prefinished items not to be painted include the following factory-finished components, but not limited to:
      a. Metal toilet enclosures.
      b. Acoustic materials.
      c. Architectural woodwork and casework.
      d. Finished mechanical and electrical equipment.
      e. Light fixtures.
      f. Distribution cabinets.
   2. Concealed surfaces not to be painted include wall or ceiling surfaces in the following generally inaccessible areas:
      a. Foundation spaces.
      b. Furred areas.
      c. Utility tunnels.
      d. Pipe spaces.
      e. Duct shafts.
   3. Finished metal surfaces not to be painted include:
      a. Anodized aluminum.
      b. Stainless steel.
      c. Chromium plate.
      d. Copper.
      e. Bronze.
      f. Brass.
   4. Operating parts not to be painted include moving parts of operating equipment such as the following:
      a. Valve and damper operators.
      b. Linkages.
      c. Sensing devices.
      d. Motor and fan shafts.
   5. Labels: Do not paint over Underwriter's Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections: The following Sections contain references pertaining to this Section:
   1. Section 05120 - Structural Steel.
   2. Section 05500 - Metal Fabrications.
   3. Section 11 53 13 - Laboratory Fume Hoods.

4. Section 12 35 53 - Metal Laboratory Casework.
5. Section 08105 - Hollow Metal Doors and Frames.
6. Section 23010 - Mechanical General Provisions
7. Section 26050 - Basic Materials and Methods - Electrical.

1.02 REFERENCES:

A. Reference Documents:
1. Steel Structures Painting Council (SSPC), Volume 1 and 2.
2. Steel Structures Painting Council (SSPC), Visual Standard (VIS 1-89).
3. American Society for Testing and Materials (ASTM).
4. American National Standards Institute (ANSI), Standard A-13.1, "Scheme for Identification of Piping Systems".

1.03 DEFINITIONS:

A. "Paint" as used herein means all coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.04 SUBMITTALS:

A. Submit under provisions of Section 01 33 23.

B. Product Data: for each paint system specified, including block fillers and primers.
1. Provide the manufacturer's technical information including label analysis and instructions for handling, storage, and application of each material proposed for use.
2. List each material and cross-reference the specific coating, finish system, and application. Identify each material by the manufacturer's catalog number and general classification.
3. Product data sheets shall indicate the mixing and thinning directions, and recommended spray nozzles and pressures.

C. Samples for Verification Purposes: Provide samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate. Define each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
1. Provide a list of material and application for each coat of each sample. Label each sample as to location and application.
2. Submit samples on the following substrates for the ARCHITECT-ENGINEER'S review of color and texture only:
a. Concrete: Provide two 4-inch-square samples for each color and finish.
b. Concrete Masonry: Provide two 4- by 8-inch samples of masonry, with mortar joint in the center, for each finish and color.
c. Painted Wood: Provide two 12- by 12-inch samples of each color and material on hardboard.
d. Ferrous Metal: Provide two 4-inch-square samples of flat metal and two 8-inch-long samples of solid metal for each color and finish.

D. Provide material safety data sheets.

1.05 QUALITY ASSURANCE:

A. Engage an experienced applicator who has completed painting system applications similar in material and extent to those indicated for the project that have resulted in a construction record of successful in-service performance.

B. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.

C. Material Quality: Provide the manufacturer's paint material of the various coatings as specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
   1. Federal Specifications establish a minimum quality level for paint materials except where other product identification is used. Provide written certification from the manufacturer that materials provided meet or exceed these criteria.

D. On wall surfaces and other exterior and interior components, duplicate finishes of prepared samples. Provide full-coat finish samples on at least 100 sf of surface until required sheen, color and texture are obtained; simulate finished lighting conditions for review of in-place work.
   1. Final acceptance of colors will be from job-applied samples.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's lot number.
   4. Manufacturer's stock number and date of manufacture.
   5. Contents by volume, for pigment and vehicle constituents.
   6. Thinning instructions.
   7. Application instructions.
   8. Color name and number.
   9. Handling instructions and precautions.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45° F (7° C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1.07 PROJECT/SITE CONDITIONS:

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50° F (10° C) and 90° F (32° C). Maintain these temperatures throughout the minimum cure time recommended by the manufacturer.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45° F (7° C) and 95° F (35° C). Maintain these temperatures throughout the minimum cure time recommended by the manufacturer.

C. The coatings shall be supplied for normal use without thinning. If it is necessary to thin the coating for proper application in cool weather, or to obtain better coverage of the urethane protected coat, the thinning shall be done in accordance with manufacturer's recommendations.

D. Do not apply paint in snow, rain, fog, or mist, when the relative humidity exceeds 85 percent, at steel surface temperatures less than 5° F (3° C) above the dew point, or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

DEW POINT CHART

Ambient Air Temp. (F) — Relative Humidity (%)

Ambient Air Temp. (F)	Relative Humidity (%)																
120									16	25	32	40	50	61	72	86	
115								15	22	30	40	50	61	71	85	99	
110	Severe Drying Conditions						13	20	29	37	49	58	70	85	99		
105							16	25	35	46	58	70	84	99			
100	May Exist in This					13	22	32	43	55	69	83	99				
95					9	18	29	40	53	68	82	99	Use Caution When				
90	Area or When R. H. is				14	25	37	50	66	81	99		Conditions Exist in				
85				9	21	34	48	64	81	99			Shaded Areas or at				
80	Less Than 8%			17	30	45	61	80	99				Rel. Hum. 80%-86%				
75			11	26	41	59	79	99									
70			20	38	56	78	99										
65		14	32	53	75	99			Do Not Paint When								
60	8	27	49	73	99				Relative Humidity								
55	20	45	71	98					Exceeds 90%								
50	11	39	69	98													
45	33	65	97														
40	60	96															
	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115

Surface Dew-Point Temperature (F)

1.08 WARRANTY:

A. CONTRACTOR shall warrant to the OWNER that the applied coating system shall be free of defects, defined and determined by visual inspection and paint thickness measurements for a period of one (1) year from the date of final inspection by ARCHITECT- ENGINEER.

B. Coated areas which show evidence of premature failure shall be removed by suitable means and the entire coating system reapplied at CONTRACTOR'S expense.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Manufacturer: Provide manufacturer products as specified in the paint schedules for the required applications in Part 3 of this Section.

2.02 PAINT MATERIALS:

A. Material Compatibility: Provide block fillers, finish coat materials, and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.

B. Colors: Provide color selections made by the OWNER from the manufacturer's full range of standard colors.

2.03 GLOSS LEVELS:

A. Gloss Levels: Provide paint with gloss levels as follows, and in accordance with the National Paint and Coatings Association (NPCA):

Sheen Level	Test Method	General Gloss Range	Ceilings and Fog Sprays
Flat	85° Meter	Below 15	Below 5
Low Sheen	85° Meter	--	3 to 18
Eggshell	60° Meter	5 to 20	8 to 20
Satin	60° Meter	15 to 35	15 to 30
Semi-Gloss	60° Meter	30 to 65	25 to 50
Gloss	60° Meter	Over 65	Over 50

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint. Do not begin paint application until unsatisfactory conditions have been corrected.
1. Start of painting will be construed as the applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates on request. Furnish information on characteristics of finish materials to ensure use of compatible primers.
1. Notify the ARCHITECT-ENGINEER about anticipated problems using the materials specified over substrates primed by others.

3.02 PREPARATION:

A. General Procedures: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items, if necessary, for complete painting of the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.
1. Clean surfaces before applying paint or surface treatments. Remove oil and grease prior to cleaning. Schedule cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

B. Surface Preparation: Clean and prepare surfaces to be painted in accordance with the manufacturer's instructions and SSPC for each particular substrate condition and as specified.
1. Provide barrier coats over incompatible primers or remove and re-prime. Notify ARCHITECT-ENGINEER in writing of problems anticipated with using the specified

finish-coat material with substrates primed by others.

2. Cementations Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove chalk, dirt, dust, efflorescence, grease, laitance, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
   a. Use abrasive blast-cleaning methods if recommended by the paint manufacturer.
   b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
   c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, and rinse; allow to dry and vacuum before painting.
   d. Thin first coat of coal tar to allow penetration into concrete, per manufacturer's recommendations.
3. Ferrous Metals: Clean non-galvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances.
   a. All the surfaces to be coated shall be blast cleaned.
   b. The abrasive used for blast cleaning shall be an approved low dusting abrasive and shall have a gradation such that the abrasive will produce a uniform profile of 1 to 2.5 mils, as measured with extra coarse Testex Replica Tape.
   c. All abrasive and coating residues shall be removed from steel surfaces with a commercial grade vacuum cleaner equipped with a brush-type cleaning tool, or by double blowing. If the double blowing method is used, the exposed top surfaces of all structural steel, including flanges, longitudinal stiffeners splice plates, hangers, etc., shall be vacuumed after the double blowing operations are completed. The air hose used for blowing the steel clean shall have an in-line water trap and the air shall be free of oil and water as it leaves the air line. The steel shall then be kept dust free and primed within eight (8) hours after blast cleaning.
   d. For interior steel not exposed to harsh conditions or chemical exposure, prep in accordance with SSPC-SP3, "Power Tool Cleaning." Removal of loose rust, loose mill scale, and loose paint to degree specified by power tool chipping, descaling, sanding, wire brushing, and grinding.
   e. For exterior steel (or interior steel exposed to harsh conditions or chemical exposure) prep in accordance with SSPC-SP6, "Commercial Blast Cleaning." Blast until at least two-thirds of the surface area is free of all visible residues.
   f. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.
4. Non-Ferrous: Clean non-ferrous surfaces with non-petroleum-based solvents so that the surface is free of oil and surface contaminants as defined in SSPC-SP1.
5. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
   a. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer before application of primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
   b. Prime, stain, or seal wood to be painted immediately upon delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.
   c. Back prime paneling on interior partitions where masonry, plaster, or other wet

wall construction occurs on backside.

d. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately upon delivery.

C. After proper preparation and cleaning, and immediately before painting, remove dirt, dust, and other contaminants from the surface by brushing, blowing with clean, dry air, or by vacuum cleaning.

D. Materials Preparation: Carefully mix and prepare paint materials in accordance with manufacturer's directions.

1. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
3. Use only thinners approved by the paint manufacturer, and only within recommended limits.
4. For Epoxy, Coal Tar Epoxy, and Urethane Coatings: Mix coatings with a high shear mixer (such as Jiffy Mixer) in accordance with the manufacturer's directions, to a smooth, lump-free consistency. Paddle mixers or paint shakers are not permitted. Mix in the original containers as far as possible and continue mixing until all of the metallic powder or pigment is in suspension. Exercise care to ensure that all of the coating solids that may have settled to the bottom of the container are thoroughly dispersed. Strain the coating through a screen having openings no larger than those specified for a No. 50 sieve per ASTM E11. After straining, the mixed primer shall be kept under continuous agitation up to and during the time of application.

3.03 APPLICATION:

A. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, faying surfaces, or conditions detrimental to formation of a durable paint film.

1. Paint colors, surface treatments, and finishes are indicated in "schedules."
2. Provide finish coats that are compatible with primers used.
3. Where epoxy coatings will be used, test existing coatings and substrates for lifting. If they lift, remove them.
4. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.
5. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
6. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.
7. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.

8. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
9. Paint backsides of access panels and removable or hinged covers to match exposed surfaces.
10. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
11. Finish exterior doors on tops, bottoms, and side edges same as exterior faces.
12. Sand lightly between each succeeding enamel and varnish coat.
13. Omit primer on metal surfaces that have been shop-primed and touch up painted.

C. Proper curing conditions for ferrous metals will be required between the applications of all coats. The minimum curing time between coats and the maximum time between coats shall be in accordance with the manufacturer's recommendation except that no more than sixty (60) calendar days will be permitted between coats. If the maximum time between coats is exceeded, all newly coated surfaces shall be completely blast cleaned again to a near-white finish (SSPC-SP10) and recoated and shall be at the CONTRACTOR's expense. After the steel is primed, it shall be vacuumed again before subsequent coating. If for any reason this vacuuming does not remove all the accumulated dust and/or dirt, or if more than three (3) weeks has elapsed since the steel was primed, or if in the opinion of the ARCHITECT-ENGINEER the surface is unfit for top-coating, the surface shall be scrubbed with a mild detergent solution (any commercial laundry detergent) and thoroughly rinsed with water and allowed to dry for twenty-four (24) hours before the surface is coated.

D. Minimum Coating Thickness: Apply materials at not less than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer and as stated in paint schedules. If the application of coating at the required thickness in one (1) pass produces runs, bubbles, or sags, the coating shall be applied in multiple passes, the passes separated by several minutes. Where excessive coating thickness produces mud-cracking, such coating shall be scraped back to soundly bonded coating and the area recoated to the required thickness. All dry spray shall be removed, by sanding if necessary. In areas of deficient primer thickness, the areas shall be thoroughly cleaned with power washing equipment, as necessary to remove all dirt; the areas shall then be wire brushed, vacuumed, and recoated. Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats are applied.

E. Mechanical and Electrical Work: Painting mechanical and electrical work is limited to items exposed in mechanical equipment rooms and in occupied spaces.

F. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

G. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

H. Transparent (Clear-White) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.

I. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

J. All metal coated with impure unsatisfactory or unauthorized coating material or coated in an

unworkmanlike or objectionable manner, shall be thoroughly cleaned and recoated or otherwise corrected as directed by the ARCHITECT-ENGINEER.

3.04 FIELD QUALITY AND CONTROL:

A. The CONTRACTOR shall provide access to the job site and areas of work at all times during normal working hours for the OWNER. This requirement includes both shop and field work.

B. The field inspection shall be performed by the ARCHITECT-ENGINEER or OWNER'S REPRESENTATIVE according to the following outline.
   1. Surface Preparation:
      a. Surface appearance per SSPC checked with visual standards.
      b. Anchor profile checked with replica tape.
   2. Coating Conditions:
      a. Temperature of steel using a surface thermometer.
      b. Determination of relative humidity and dew point and air temperature using a sling psychrometer.
   3. Verify Coating Thickness:
      a. Dry film thickness will be determined by use of a magnetic film thickness gauge.
      b. Pinholes will be checked using a holiday detector.

C. Surfaces other than steel shall be visually inspected by the ARCHITECT-ENGINEER or OWNER'S REPRESENTATIVE.

D. Failure to comply with these specifications in any manner shall be sufficient cause for rejection of work.

3.05 CLEAN-UP AND PROTECTION:

A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

B. Upon completion of painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping, using care not to scratch or damage adjacent finished surfaces.

C. Protect work of other trades, whether to be painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to ARCHITECT-ENGINEER.

D. Provide "wet paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.
   1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 EXTERIOR PAINT SCHEDULE:

A. General: Provide the following paint systems for the various substrates indicated.

B. Concrete (Where specified):
   1. Lusterless (flat) Acrylic Finish:
      a. Primer: Waterborne modified polyamine epoxy
         1) Tnemec Series 151, 1.0 to 1.5 mils D.F.T.

b. Finish Coat: Acrylic emulsion.
1) Tnemec Series 6, 2.0 to 3.0 mils D.F.T.

C. Concrete Masonry Units (Where specified):
1. Lusterless (flat) Acrylic Finish: Two (2) coats over block filler with total dry film thickness not less than 2.5 mils, excluding the block filler.
a. Block Filler: High-performance, latex block filler:
b. Second and Third Coats - exterior acrylic emulsion:

D. Ferrous Metal:
1. Industrial or commercial: (Surface preparation SSPC-SP6).
a. Primer: Synthetic rust-inhibiting primer 2 mils D.F.T.
b. First and Second Coats: Gloss alkyd enamel 1.5 mils DFT each coat.

E. Zinc-Coated (Galvanized) Metal:
1. Industrial or commercial: (Surface preparation SSPC-SP 1 & 2).
a. Primer: Galvanized metal primer .5 mils D.F.T.
b. First and Second Coats: Gloss alkyd enamel 2 mils D.F.T.
2. Chemical Plant and Wastewater Treatment Non-Submerged: (Surface preparation SSPC-SP 1 & 2).
a. First Coat: Epoxy 2.0 mils D.F.T.
b. Second Coat: Epoxy 4.0 mils D.F.T.
c. Third Coat: Urethane 1.5 mils D.F.T.

F. Steel Pipe:
1. Chemical Plant and Wastewater Treatment Non-Submerged: (Surface Tolerant) (Surface preparation SSPC-SP2 and 3).
a. First Coat: Epoxy Mastic 5 mils D.F.T.
b. Second Coat: Urethane 2.0 mils D.F.T.

G. Aluminum:
1. Industrial or Commercial. (Surface preparation SP #1).
a. Primer: Alkyd-type primer 1.5-2.0 mils D.F.T.
b. First and Second Coats: Gloss alkyd enamel 3.0 mils D.F.T.

3.07 INTERIOR PAINT SCHEDULE:

A. General: Provide the following paint systems for the various substrates, as indicated.

B. Concrete (Where specified):
1. Lusterless (flat) Finish: Two (2) coats:
a. Primer: Interior, flat, latex-based paint, 1.0-1.5 mils D.F.T. each coat.
b. Second Coat: Interior, flat, latex-based paint 1.5-2.0 mils D.F.T.
2. Semi-gloss Enamel Finish: Three (3) coats with total dry film thickness not less than 3.5 mils.
a. Primer: Interior, flat, latex-based paint.
b. Undercoat: Interior enamel undercoat.
c. Finish Coat: Interior, semi-gloss, odorless, alkyd enamel.

C. Concrete Masonry Units:
1. Lusterless (flat) Emulsion Finish: Two (2) finish coats over filled surfaces.
a. Block Filler: High-performance latex block filler.
b. First and Second Coats: Interior, flat, latex-based paint 1.5 mils D.F.T. each.

2. Semi-Gloss, Alkyd, Enamel Finish: Two (2) coats over filled surface with total dry film thickness not less than 3.5 mils, excluding filler coat.
    a. Block Filler: High-performance latex block filler.
    b. Undercoat: Interior enamel undercoat.
    c. Finish Coat: Interior, semi-gloss, odorless, alkyd enamel.

D. Gypsum Drywall Systems (When specified):
1. Lusterless (flat) Emulsion Finish: Two (2) coats.
    a. Primer: White, interior, latex-based primer.
    b. Finish Coat: Interior, flat, latex-based paint.
2. Semi-Gloss Enamel Finish: Three (3) coats with total dry film thickness not less than 2.5 mils.
    a. Primer: White, interior, latex-based primer.
    b. First and Second Coats: Interior, semi-gloss, odorless, alkyd enamel.
3. Full-Gloss Enamel Finish: Two (2) coats.
    a. Primer: White interior, latex-based primer, 1.0-1.5 mils D.F.T.
    b. Finish Coat: Water-based acrylic high-gloss enamel, 1.5-2.0 mils D.F.T.

E. Projection Drywall Systems (When specified):
1. Projection Screen Finish: Two (2) coats.
    a. Primer: Acrylic coating.
        1) Screen Goo White Reflective Coating, 1.5 mils D.F.T.
    b. Finish Coat: Acrylic coating.
        1) Screen Goo White Finish Coating, 1.5 mils D.F.T.

F. Woodwork and Hardboard (When specified):
1. Semi-Gloss Enamel Finish: Three (3) coats.
    a. Undercoat: Interior enamel undercoat 1.5 mils D.F.T.
    b. First and Second Coats: Interior, semi-gloss, odorless, alkyd enamel 2.5 mils total D.F.T.
2. Full-gloss Enamel Finish: Three (3) coats.
    a. Undercoat: Interior enamel undercoat 1.5 mils D.F.T.
    b. First and Second Coats: Gloss alkyd enamel 2.5 mils total D.F.T.

G. Ferrous Metal:
1. Industrial or Commercial. (Surface preparation SSPC-SP6 Interior) for non-exposed steel surfaces: Surface prep SSPC-SP6 and shop prime only.
    a. Primer: Synthetic, quick-drying, rust-inhibiting primer, 2 mils D.F.T.
    b. Undercoat: Interior enamel undercoat, 1.5 mils D.F.T.
    c. Finish Coat: Exterior, gloss, alkyd enamel., 1.5 mils DFT
2. Steel Roof Joists, Roof Beams, and Roof Deck: Dry-fog spray over shop primer. Overspray falls to floor as dry dust. Use proper atomizing tip on spray equipment.
    a. Finish Coat:

H. Zinc-Coated (galvanized) Metal:
1. Industrial or Commercial. (Surface preparation SP #1 & #2).
    a. Primer: Galvanized metal primer, 1.0 mils D.F.T.
    b. Undercoat: Interior enamel undercoat, 1.5 mils D.F.T.
    c. Finish Coat: Exterior, gloss, alkyd enamel, 1.5 mils D.F.T.
2. Galvanized Roof Deck: Dry-fog spray over cleaned and primed galvanized deck.
    a. Primer - Galvanized Metal Primer: 1.5 mils D.F.T.
    b. Finish Coat: 1.5 mils D.F.T.

NOTE: In situations where two colors do not have sufficient contrast to easily differentiate between them, paint a 6-inch band of contrasting color on one of the pipes at approximately 30-inch intervals. The name of the liquid or gas should also be on the pipe. In some cases, it may be advantageous to provide arrows indicating the direction of flow.

I. Reference is made to Steel Structures Painting Council (SSPC) surface preparation specifications for recommended surface cleaning.

1. SP #1 - Solvent Cleaning: Removal of oil, grease, dirt, soil, salts and contaminants by cleaning with solvent, vapor, alkaline emulsion, or steam.
2. SP #2 - Hand Tool Cleaning: Removal of loose rust, loose mill scale and loose paint to degree specified, by hand chipping, scraping, sanding, and wire brushing.
3. SP #3 - Power Tool Cleaning: Removal of loose rust, loose mill scale and loose paint to degree specified, by power tool chipping, descaling, sanding, wire brushing, and grinding.
4. SP #5 - White Metal Blast Cleaning (NACE #1): Removal of all visible rust, mill scale and foreign matter by blast cleaning with wheel or nozzle (dry or wet) using sand, grit, or shot. (Used for corrosive atmosphere where high cost of cleaning is warranted).
5. SP #6 - Commercial Blast Cleaning (NACE #3): Blast cleaning until at least two-thirds of the surface area is free of all visible residue.
6. SP #7 - Brush-Off Blast Cleaning (NACE #4): Blast cleaning of all except tightly adhering residues of mill scale, rust, and coatings, exposing numerous evenly distributed flecks of underlying metal.
7. SP #8 - Pickling: Complete removal of rust and mill scale by acid pickling, duplex pickling, or electrolytic pickling.
8. SP #10 - Near-White Blast Cleaning (NACE #2): Blast cleaning nearly to white metal cleanliness, until at least 95% of the surface area is free of all visible residue. (Used for high humidity, chemical atmosphere, marine, or other corrosive environments.)
9. SP #11 - Power Tool Cleaning to Bare Metal: Power tool cleaning down to bare metal using impact or rotary power tools, or rotary impact flap assemblies to roughened, cleaned, and bared metal.
10. SP #12 - High and Ultra-High Pressure Water Jet Cleaning (NACE #5): Removal of oil, grease, and foreign matter by ultra-high water jetting, by steam cleaning with detergent, or by methods in accordance with SP #1. The difference in degrees of surface cleanness is defined by the amount of pressure as follows:
    a. LP WC – Low Pressure Water Cleaning: 5,000 psi
    b. HP WC – High Pressure Water Cleaning: 5-10,000 psi
    c. HP WJ – High Pressure Water Jetting: 10-25,000 psi
    d. UHP WJ – Ultra-High Pressure Water Jetting: over 25,000 psi

END OF SECTION

SECTION 12 35 53
METAL LABORATORY CASEWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Metal laboratory casework and related equipment as indicated in the specifications and on the drawings.

B. Types of products in this section include the following:
1. Steel casework.
2. Work surfaces.
3. Sinks and outlets (counter mounted).
4. Service fittings.
5. Accessory equipment.
6. Hoods.

1.02 RELATED SECTIONS

A. Refer to plumbing, HVAC and electrical specifications for related work and installation required by those trades.

1.03 SUBMITTALS

A. Submit under provision per Division 1.

B. Submit the following in accordance with Conditions of Contract and Division Specification sections.

C. Product data and installation instructions for metal casework units.

D. Color Samples on squares of same metal to be used for fabrication of casework.

E. Shop Drawings that show metal cabinets in dimensioned relation to adjacent surfaces. Show cabinets in detail, method of installation, fillers, trim, base, and accessories.

1.04 QUALITY ASSURANCE

A. Uniformity: Provide metal cabinets that are standard products of single manufacturer, with interchangeable like parts. Include necessary mounting accessories, fittings, and fastenings. Each cabinet is to be a complete welded assembly without applied panels at ends, backs or bottoms, so that cases can be used interchangeably or as a single, stand-alone unit.

1.05 GUARANTEE

A. The casework contractor shall guarantee all materials and workmanship of equipment provided under this contract for a period of one year from date of shipment. Any defects due to the use of improper materials or workmanship, occurring within that time shall be promptly rectified by this contractor at his own expense upon notification by the owner or architect of this condition.

1.06 SITE CONDITIONS

A. Do not deliver metal cabinets until building laboratory areas are ready for installation. Protect from damage during delivery, handling, storage, and installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. All laboratory casework covered by this specification shall be the product of one manufacturer. Manufacturers furnishing equipment shall have been engaged in work of this type, for at least five years and shall have completed five installations of equivalent size.

B. Manufacturer: Subject to compliance with requirements of this section, provide products of one of the following:
1. BMC Metal Arc is the basis of design.
2. NuAire Inc.
3. Hanson Lab Furniture Inc.
4. Jamestown Metal Products.
5. Hamilton Scientific.
6. New England Lab.

2.02 MATERIALS

A. Sheet Steel: Mild cold-rolled and leveled unfinished furniture steel, per ASTM A611 free from buckle, scale, and surface imperfections.

B. Minimum Gauges:
1. 20 gauge: Exterior/interior drawer fronts, interior door panels, scribing strips, filler panels, enclosures, drawer bodies, shelves, security panels and sloping tops.
2. 18 gauge: Door fronts, case tops, ends, bottoms, bases, backs, vertical posts, uprights, and access panels.
3. 16 gauge: Top front rails, top rear gussets, intermediate horizontal rails, table legs and frames, leg rails and stretchers.
4. 14 gauge: Drawer suspensions, door and case hinge reinforcements and front corner reinforcements.
5. 11 gauge: Table leg corner brackets and gussets for leveling screws.

2.03 CASEWORK FABRICATION

A. Base Units, Wall, Upper and Tall Cases:
1. Base units and 25", 31" and 37" high wall cases: End panels and back reinforced with internal reinforcing front and rear posts. Base units shall be 22" overall in depth.
2. 25", 31", 49" and 84" high tall cases: Formed end panels with front and rear reinforcing post channels; back shall be formed steel panel, recessed 3/4" for mounting purposes.
3. Posts: Front post fully closed with full height reinforcing upright. Shelf adjustment holes in front and rear posts shall be perfectly aligned for level setting, incrementally adjustable to 1/2" o.c. full height of unit.
4. Secure intersection of case members with spot and arc welds. Provide gusset reinforcement at front corners.
4. Base unit backs: Provide drawer units without backs and cupboard units with removable backs for access to services behind units at island cabinets.
5. Base unit backs: Provide fixed backs at all drawer and cupboard units. No access to services behind.
6. Bottoms: Base units and 25", 31", 37" and 49" high wall and upper cases shall have one piece bottom with front edge formed into front rail, rabbeted as required for swinging doors and drawers and flush design for sliding doors.
7. Top rail for base units: Interlock with end panels, flush with front of unit.
8. Horizontal intermediate rails: Recessed behind doors and drawer fronts.

9. Base for base units: 4" high x 3" deep with formed steel base and 11 ga. die formed steel gussets at corners. Provide 3/8" diameter leveling screw with integral bottom flange of minimum 0.56 sq. in. area at each corner, accessible through openings in toe space.
10. Tops of wall and upper cases: One piece, with front edge formed into front rail.

B. Drawers
1. Steel Drawer Fronts: 3/4" thick, double wall steel construction, prepainted prior to assembly and sound deadened; top front corners welded and ground smooth. Drawer heads shall incorporate ½" vertical radiuses on the outer two edges.
2. Drawer bodies: Bottom and sides formed from one-piece, cold rolled steel with bottom and sides coved (1/4" minimum) and formed top edges. Front and back panels spot welded to center section.
3. Drawer suspension: Heavy duty coved raceways for both case and drawer with nylon tired, ball bearing rollers; self-centering and self-closing when open to within 3" of the closed position.
    a. SEFA 8 Heavy Duty Laboratory 150 lb. Load – Accurride (or equal) 150 lb. full extension, ball bearing, and drawer slides. Tested to full extension for 50,000 cycles at a rate not to exceed 10 cycles per minute without failure or permanent deformation. File drawers: provide with 150 lb. full extension slides for full access and operation.
4. Provide drawer with rubber bumpers. Friction centering devices are not acceptable.
5. Provide security panels for drawers with keyed different locks.
6. File drawers: Provide with 150# full extension slides for full access and operation.

C. Doors:
1. Steel Solid Panel Doors: 3/4" thick, double wall, telescoping box steel construction with interior prepainted and sound deadened, all outer corners welded and ground smooth. Reinforce interior of front panel with welded steel hat channels. Hinges with screws to internal 14 gauge reinforcing in case and door. Hinges shall be removable; welding of hinges not acceptable. Dorr hinges shall have a cabinet opening angle of 165°. Self-closing, concealed hinges shall close against rubber bumpers. Door catches are not acceptable. Door heads shall incorporate ½" vertical radiuses on the outer two edges.

D. Shelves:
1. Form front and back edges down and back 3/4". Form ends down 3/4".
2. Reinforce shelves over 36" long with welded hat channel reinforcement the full width of shelf.
3. Pull out shelves: Same suspension as specified for drawers.

E. Base molding: 4" high, to be furnished and installed by flooring contractor.

F. Hardware: Drawer and hinged door pulls.
1. Nickel matt waterfall pull
2. Hinges: Institutional type, Concealed hinge, three point adjustment, nickel plated steel. Self-closing mechanism (No catch is required). Hinge allows 165 degree swing of doors for full access of cabinet. Provide two hinges for doors up to 36" high; three hinges for doors over 36" high. Drill each leaf for two screw attachment to door and frame.
3. Label holders: Formed stainless steel brushed finish, 1" x 1-1/2", screw installed.
4. Shelf clips: Die formed steel, zinc plated, designed to engage in shelf adjustment holes.

2.04 METAL FINISH:

A. Preparation: Spray clean metal with a heated cleaner/phosphate solution, pre-treat with iron phosphate spray, water rinse, and neutral final seal. Immediately dry in heated ovens, gradually cooled, prior to application of finish.

B. Application: Electrostatically apply urethane powder coat of selected color and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high grade laboratory furniture quality finish of the following thicknesses:
1. Exterior and interior surfaces exposed to view: 1.5 mil average and 1.2 mil minimum.
2. Backs of cabinets and other surfaces not exposed to view: 1.2 mil av.

C. Cabinet Surface Finish Tests:
1. All casework construction and performance characteristics shall be in full compliance with SEFA 8 – 1999 standards. Laboratory grade finishes should result in no more than four Level 3 Conditions after the finish tests. Provide documentation.

2.05 WORK SURFACE

A. Material: Chemical and abrasion resistant, durable top of one inch thick cast material of epoxy resins and inert products, cast flat, with a uniform non-glare black matte finish except where indicated as stainless steel in the Organic Lab.

B. Backsplash curb: Same material as top, height as indicated on drawings, integral with top, with 5/8" coved juncture to top surface. Provide where indicated on drawings. Include end curb where top abuts end wall.

C. Reagent ledges: Same material as top. Provide 6" high x 7-1/2" wide single faced units and 6" high x 9" wide double faced units or as shown on drawings. Ledge face shall permit installation of service fixtures and top shall be removable for access to service utilities.

2.06 WORK SURFACE PERFORMANCE REQUIREMENTS

A. Test procedure: Apply five drops of each reagent to surface and cover with 25mm watch glass, convex side down; test volatiles using one ounce bottle stuffed with saturated cotton. After 24 hour exposure flush surface, clean, rinse and wipe dry.

B. Evaluation ratings: Change in surface finish and function shall be described by the following ratings:
1. No Effect: No detectable change in surface material.
2. Excellent: Slight detectable change in color or gloss, but no change to the function or life of the work surface material.
3. Good: Clearly discernible change in color or gloss, but no significant impairment of work surface function or life.
4. Fair: Objectionable change in appearance due to surface discoloration or etch, possibly resulting in deterioration of function over an extended period.
5. Poor: Pitting, cratering or permanently etching of work surface material; obvious and significant deterioration.

C. Test Results - Epoxy Resin Work Surface (Black):

	CHEMICAL - ACIDS		RATING
1.	Hydrochloric Acid	20%	No Effect
2.	Hydrochloric Acid	37%	No Effect

3.	Nitric Acid	20%	Excellent
4.	Nitric Acid	70%	Good
5.	Sulfuric Acid	25%	Poor
6.	Sulfuric Acid	85%	Poor
7.	Sulfuric Acid	96%	Poor
8.	Phosphoric Acid	85%	No Effect
9.	Perchloric Acid	60%	No Effect
10.	Aqua Regia	--	No Effect
11.	Chromic Acid	60%	Good
12.	Acetic Acid	98%	No Effect
13.	Formic Acid	90%	No Effect
14.	Boric Acid	Sat.	No Effect
15.	Citric Acid	Sat.	No Effect
16.	Oxalic Acid	Sat.	No Effect
17.	Hydrobromic Acid	48%	No Effect
18.	Hydrofluoric Acid	48%	Good
19.	Vinegar	--	No Effect
	CHEMICAL - BASES		
20.	Ammonium Hydroxide	28%	No Effect
21.	Sodium Hydroxide	10%	No Effect
22.	Sodium Hydroxide	40%	No Effect
23.	Sodium Hydroxide	Flake	No Effect
24.	Potassium Hydroxide	10%	No Effect
	CHEMICAL - SALTS		
25.	Zinc Chloride	Sat.	No Effect
26.	Calcium Hypochlorite	Sat.	No Effect
27.	Clorox Bleach	--	No Effect
28.	Silver Nitrate	10%	No Effect
29.	Sodium Sulfide	Sat.	No Effect
30.	Sodium Chloride	Sat.	No Effect
31.	Iodine, Tincture	--	No Effect
32.	Hydrogen Peroxide	--	No Effect
33.	Phenol	80%	No Effect
34.	Cresol	--	No Effect
35.	Formaldehyde	40%	No Effect
36.	Mineral Oil	100%	No Effect
37.	Glycerin	100%	No Effect
	CHEMICAL - SOLVENTS		
38.	Methyl Alcohol	100%	No Effect
39.	Ethyl Alcohol	100%	No Effect
40.	Butyl Alcohol	100%	No Effect
41.	Naphtha	100%	No Effect
42.	Turpentine	100%	No Effect
43.	Kerosene	100%	No Effect
44.	Heptane	100%	No Effect
45.	Gasoline	100%	No Effect
46.	Benzene	100%	No Effect
47.	Toluene	100%	No Effect
48.	Xylene	100%	No Effect
49.	Acetone	100%	No Effect
50.	Methyl Ethyl Ketone	100%	No Effect
51.	Methyl Isobutyl Ketone	100%	No Effect
52.	Ethyl Acetate	100%	No Effect
53.	Ethyl Ether	100%	No Effect

54.	Chloroform	100%	No Effect
55.	Methyl Chloride	100%	No Effect
56.	Trichlorethylene	100%	No Effect
57.	Carbon Tetrachloride	100%	Excellent
58.	Monochlorobenzene	100%	No Effect
59.	Dioxane	100%	No Effect
60.	Furfural	--	No Effect
	CHEMICAL - DYES		
61.	Congo Red	1%	No Effect
62.	Eosin Y	0.5%	No Effect
63.	Gentian Violet	1%	No Effect
64.	Indigo Carmen	0.5%	No Effect
65.	Methyl Green	0.5%	No Effect
66.	Wrights Blood Stain	0.35%	No Effect

2.07 SINKS, DRAINS AND TRAPS

A. Epoxy resin sinks: Integrally molded from modified thermosetting black epoxy resin, specially compounded and oven cured. Cove inside corners and pitch bottom to threaded drain outlet.
   1. Size: Per Drawings.
   2. Drain location: Corner.
   3. Drop in mounting.

B. Sink supports:
   1. Cabinet sinks: Support sinks on 11 gauge, adjustable, 1" x 2" x 1" channel with reagent resistant finish. Provide two channels across width of cabinet, attached to 3/8" diameter threaded hanger rods.
   2. Caulk joint between top and sink with non-hardening mastic.

C. Traps: 1-1/2" size, type P in thermoplastic polyethylene.

2.08 LABORATORY FITTINGS

A. Water Service Fittings:
   1. Water service faucets and valves shall have renewable unit containing all working parts subject to wear, including replaceable stainless steel seat. Unit shall have serrations for position locking into valve body.
   2. Gooseneck w/ vacuum breakers: Brass forgings integral with gooseneck, with renewable seat and special design valve member for fine flow control.
   3. Goosenecks shall have separate 3/8" IPS coupling securely brazed to gooseneck to provide full thread for attachment of anti-splash outlet fittings, serrated tips and filter pumps.
   4. All exposed parts to be epoxy coated.

B. Air, Gas and Vacuum Systems Fittings:
   1. Needle valves: Small pattern needle valve, straightway type with stainless steel replaceable floating cone and brass seat (non-renewable). Ten serrated end is integral with valve body.
   2. Ground key cocks: Straightway ground key cocks, individually ground and lapped and tested at 100 psi. air under water. Cocks shall have single arm long easy grip handle with screw-on type index. Ten serrated end is integral with valve body.

C. Distilled Water Fittings: All brass fittings tin lined for distilled water service.
   1. Provide renewable tin lined unit containing all working parts subject to wear, including replaceable stainless steel seat. Unit shall have serrations for position locking into valve body.
   2. All exposed parts to be epoxy coated.

D. Turrets for gas, air, vacuum, steam or water fixtures: "Round" type design, provided with brass shanks, locknuts and washers.

E. Handles for service cocks, faucets and remote controls: Four-arm type except ground key cocks. Provide removable screw-on type colored plastic discs with letter stamped on disc in contrasting color as scheduled below:

Service	Disc/Letter Colors	Letters
Gas	Blue/White	Gas
Vacuum	Yellow/Black	Vac.
Compressed Air	Orange/White	C-Air
Cold Water	Green/White	C.W.
Hot Water	Red/White	H.W.
Steam	Black/White	Stm.
Chilled Water	Brown/White	CH.
Distilled Water	White/Black	D.W.

F. Fixture finish: Epoxy coated finish developed by the following sequence of coatings over properly prepared brass castings or forgings:

Minimum Plating	Coating Thickness
Copper (Initial)	0.000050 IN.
Nickel	0.000350 IN.
Chromium (Final)	0.000015 IN.

G. Electrical fixtures and fittings: Flush, pedestal or line type, provided in strict accordance with the current edition of the National Electric Code of the National Fire Protection Association, and with requirements of all local regulatory authorities.
   1. Pedestal and line type housings: Heavy "lustrebrite" corrosion resistant aluminum alloy polished to a chrome like color.
      a. Pedestals: Provide with integral bases; low design for use on either single or double faces.
      b. Line type housings: Similar in design to pedestals; designed to be self-supporting when installed with rigid conduit.
   2. Receptacles: Rated 120 volts A.C. at 20 amps., three wire grounding type. Provide duplex receptacles as required, with ivory or black colored molded thermo-set bodies.

2.09 ACCESSORIES

A. Pegboards:
   1. Board: Epoxy resin board finished on face and edges. Where exposed, finish back with slightly different surface texture and bevel bottom edges. Size to be 42" wide and 48" tall.
   2. Pegs: Black polypropylene pegs in 5", 6-1/2" and 8" lengths, with glassware protector base. Base of pegs shall be two prong style for mechanical attachment. Do not bond pegs to board.

B. Single Upright Rod Assembly

1. Complete unit including one 39" aluminum upright, one 22" aluminum crossbar, 1 connector, and 1 receptacle. Fisher Hamilton #26L11200 w/#26L04100 receptacle.
2. Provide where indicated on the drawings.

2.10 FUME HOODS

A. General

1. Fume hoods shall be of a "picture frame" airfoil design and construction. Each fume hood superstructure shall provide for safe efficient removal of all fumes, both heavy and light, with the least amount of turbulence as the air enters the hood.
2. Standard airfoil bench hood superstructures shall be tested in accordance with the ASHRAE 110-1995 Test Procedure and perform well within the American Conference of Governmental Industrial Hygienists recommendations.

B. Material

1. Metal: Prime furniture steel, free of scales, buckles, or other defects; ASTM A366.
2. Stainless Steel: Type 304 or 316, as noted, commercial grade, No. 4 Finish, ASTM A167 where specified.
3. Safety Glass: 1/4" Laminated; conforming to ANSI 297.1 for 400-foot-pound impact, and to CPSC 16 CFR 1201 for Category II Safety Glazing.
4. PVC: Extruded Polyvinyl Chloride where specified.
5. Resin-Chem: White chemical resistant, fiberglass reinforced thermostat resin sheet. Flame spread rating: 25.

C. Construction

1. Fume hood superstructures shall have a double wall construction consisting of an outer shell of sheet steel and an inner liner of corrosion resistant material as specified. Attachment of the interior lining material to the steel framing members shall be made with non-metallic fasteners. The double wall shall house and conceal steel framing members, attaching brackets and remote operating service fixture valves.
2. The exterior side panels of the superstructure shall be constructed of 18 gauge steel and shall be removable for access into the interior housing. Access shall also be gained through removable panels in the interior liner. These interior removable panels shall be held in place by a PVC gasket.
3. Each superstructure shall have an internal baffle system of the same material as the interior liner. This baffle system shall provide for safe efficient removal of fumes when the superstructure is connected to a properly installed exhaust system. A manual adjustment shall be provided on the upper part of the baffle to allow the operator to set the hood for heavy or light fumes. All baffles shall be removable for cleaning.
4. An LED light fixture of the size given below shall be provided in the hood roof. The light shall provide (15) intensity adjustment levels, and (3) color options. Illumination at the worksurface shall be at 100 foot-candles at the full intensity setting. The light fixture shall be isolated from the hood interior by a 1/4" thick tempered glass panel sealed from the hood cavity. Fixture shall be UL listed.
5. A duplex pedestal receptacles shall be provided inside the fume hood in each rear corner.
6. Exhaust outlets shall be round, oval or rectangular, 18 gauge type 304 stainless steel. Galvanized or painted outlets are not acceptable.
7. Fume hoods shall have a full view, vertical rising, laminated safety glass sash framed with a solid black, PVC extrusion. The sash shall have a full width extruded PVC finger lift. The finger lift shall have a 16 gauge steel tube inserted the full width of the finger lift and shall be fully enclosed by PVC. Sashes with stainless steel or coated steel finger lifts are not acceptable. The sash shall not require the use of a center mullion. Sash guides shall be extruded, black PVC.

8. The sash shall be counter balanced with a single weight located in the center rear of the superstructure. Two 1/8" diameter stainless steel cables shall connect the sash to the weight. The use of two cables shall act as a safety mechanism keeping the sash from falling in the event that one cable would fail. The cables shall ride on 2" diameter nylon ball bearing pulleys. The cable/pulley assembly shall have an adjustment located on the top of the superstructure for proper alignment of the sash. A cable keeper clip shall be installed on each pulley to prevent the cable from coming off the pulley.
9. A lower airfoil of 14 gauge steel, coated with a black baked on chemical resistant finish, shall act as the sash stop. In addition, the airfoil shall provide a 1" space between the bottom of the sash, in the closed position, and the work surface. This 1" space shall provide for a continuous sweep of fumes from the work surface.

D. Bench Hoods
1. Bench fume hood superstructures shall have a white Resin-Chem interior lining.
2. Horizontal Sliding Sash: The sash shall consist of four horizontal sliding, laminated safety glass panels, with a stainless steel edge trim. The panels shall be top hung and ride in an extruded aluminum track which is mounted to a structural stainless steel beam, above the hood opening. Maximum opening of sash shall be equal to two panels.
3. Vertical Rising Sash: The sash shall consist of a single up / down counterweighted sliding sash, laminated safety glass panels, with a stainless steel edge trim.
4. Two removable interior access panels shall be located on each side of the fume hood superstructure.
5. All other features of the bench fume hood superstructure are specified under "Construction".

E. Hood Services
1. Services shall be provided in each hood as per the hood schedule. Hood shall not have any pre- punched holes on the hood post except for services per the schedule. Where multiple services are scheduled, provide one each side.
2. Service fixtures and fittings mounted inside of hood shall consist of color-coded hose nozzle outlets remotely controlled from the hood post with labeled index handles. The fixtures (valves and nozzles) shall be epoxy coated. The valve body shall be easily removed from the front for repair.
3. Service fixtures shall be provided with piping, from the outlet/valve to the exterior. Where services are scheduled on both sides of the hood, piping shall be connected for a coordinated single point connection to the building services.
4. Electrical shall be internally wired at the factory to one junction box for connection to the external electrical circuits.

F. Special Purpose Cabinets for Use Under Fume Hoods:
1. Acid Storage Cabinets
   a. Where indicated acid storage cabinets shall use the same gauges of steel and construction features as other base cabinets. In addition, they shall have a one-piece liner insert made of linear low-density polyethylene. The liner insert shall form a one-inch pan at the bottom to retain spillage. Each door will have a set of louvers at the top and bottom. The door shall be lined with a polyethylene sheet. Each cabinet shall be vented into the fume hood with a 1-1/2" flexible vent pipe, providing a positive airflow directly into the fume hood exhaust system.
2. Solvent Storage Cabinets:
   b. Solvent storage cabinets shall be FM or UL labeled and specifically designed for the storage for the storage of flammable and combustible liquids. Construction shall be based upon the requirements listed by UFC, OSHA, and NFPA No. 30 - 2003. The bottoms, top, sides and doors shall be fabricated of 18-gauge steel and

shall be all double panel construction with a 1-1/2" air space between panels. All joints shall be welded, or screwed, to provide a rigid enclosure. The doors shall swing on full-length stainless steel piano hinges and shall be fully insulated. The right hand door shall be equipped with a three point latching device and the left-hand door shall have a full height astragal. The doors shall be self-closing and synchronized so that both doors will always fully close. The right hand door shall be equipped with a three-point latching system that automatically engages when the doors close. Each door shall be equipped with a fusible-link hold-open feature that will ensure the door closes should the temperature outside the cabinet exceed 165 degrees Fahrenheit. Units 24" long shall have only one door, self-closing, and equipped with a three-point latching system and hold-open feature. A 2" deep liquid tight pan that covers the entire bottom of the cabinet shall be furnished to contain liquid leaks and spills. A full-depth adjustable shelf shall also be provided. The shelf shall be perforated to allow air circulation within the cabinet. Two diametrically opposed vents with spark screens shall be provided in the back of the cabinet as well as a grounding screw. The cabinet shall have an interior finish the same as the exterior and shall be labeled: "FLAMMABLE - KEEP FIRE AWAY".

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Casework installation:
   1. Set casework components plumb, square, and straight with no distortion and securely anchored to building structure. Level as required using cabinet levelers.
   2. Bolt continuous cabinets together with joints flush, tight and uniform, and with alignment of adjacent units within 1/16" tolerance.
   3. Secure wall cabinets to solid supporting material, not to plaster, lath or gypsum board.
   4. Abut top edge surfaces in one true plane. Provide flush joints not to exceed 1/8" between top units.

B. Work surface installation:
   1. Where required due to field conditions, scribe to abutting surfaces.
   2. Only factory prepared field joints, located per approved shop drawings, shall be permitted. Secure joints in field, where practicable, in the same manner as in factory, with dowels, splines, adhesive or fasteners recommended by manufacturer.
   3. Secure work surfaces to casework and equipment components with material and procedures recommended by the manufacturer.

C. Sink installation: Sinks which were not factory installed shall be set in chemical resistant sealing compound and secured and supported per manufacturer's recommendations.

D. Accessory installation: Install accessories and fittings in accordance with manufacturer's recommendations. Turn screws to seat flat; do not drive.

3.02 ADJUST AND CLEAN

A. Repair or remove and replace defective work, as directed by Architect upon completion of installation.

B. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly.

C. Clean shop finished casework, touch up as required.

D. Clean countertops with diluted dishwashing liquid and water leaving tops free of all grease and streaks. Use no wax or oils.

3.03 PROTECTION OF FINISHED WORK

A. Provide all necessary protective measures to prevent exposure of casework and equipment from exposure to other construction activity.

B. Advise contractor of procedures and precautions for protection of material, installed laboratory casework and fixtures from damage by work of other trades.

END OF SECTION

SECTION 22 00 00
PLUMBING GENERAL PROVISIONS

PART 1 – GENERAL

1.1 GENERAL PROVISIONS:

A. General:
1. "Provide" means furnish and install.
2. The provisions of this Section shall apply to other work specified in this Division 22 - Plumbing.
3. Although the drawings attempt to depict piping and equipment as installed, actual conditions and locations of existing may differ from that which is shown. Field verify.
4. Field mark and then verify all demolition work with Owner prior to commencing work.
5. Coordinate shutdown of all utilities with Owner prior to shutdown. Temporary shut-down and tie-ins may be required during special off-hour periods.
6. Submit equipment and product submittals to Engineer for approval prior to construction.
7. Submit equipment and product submittals to the Architect/Engineer for approval prior to construction.
8. Make sure all plumbing systems are properly tested, balanced, and placed into operation.
9. Demonstrate to the Owner and Engineer that all systems are operating as intended.
10. Provide Operation and Maintenance Manuals.
11. Train the Owner's personnel in the operation and maintenance of all equipment as required.
12. Provide "as-built" red lined drawings indicating final locations, routing, sizes, etc., of all mechanical equipment, ductwork, piping, sensors, etc.

1.2 CONSTRUCTION REQUIREMENTS:

A. If during construction of the new building, a temporary shutdown of nearby existing plumbing or piping systems is required, the Plumbing Contractor shall carefully coordinate with the Construction Manager and Owner regarding the scope and schedule of temporary shutdown.

B. The Plumbing Contractor shall carefully coordinate with the Construction Manager and Owner regarding the operation and maintenance and possible temporary shutdown of existing plumbing and piping systems that may adversely affect or be adversely affected by the new construction.

1.3 PLUMBING WORK SCOPE SUMMARY:

A. General:
1. Furnish all materials, supplies, equipment, tools, transportation and facilities, and perform all labor and services necessary for the complete installation of the plumbing systems as shown on the drawings, as herein specified, and as required to make complete and operating systems.

B. Demolition
1. Remove existing natural gas and vacuum outlets. Where new outlets are to be re-installed temporarily cap services for future reconnections. Where existing outlets are not to be replaced, remove service to below floor and cap at main.
2. Remove existing lab sinks, trim, hot water, cold water and acid waste where shown. Where new sinks are to be re-installed temporarily cap services for future reconnections. Where existing sinks are not to be replaced, remove serviced to below floor and cap at main.

C. New Work
1. Reinstall new natural gas and vacuum outlet were shown. Reconnect to existing services.
2. Install new sinks and trim including hot and cold water and acid waste to new sinks from existing services.

1.4 INTENT:

A. The intent of this Division is to call for finished work, tested and ready for operation.

B. Furnish all materials, supplies, equipment, tools, transportation and facilities, and perform all labor and services necessary for the complete installation of the mechanical systems as shown on the drawings, as herein specified, and as required to make complete and operating systems.

C. The work shall also include the completion of such details of mechanical work not mentioned or specifically shown, but which are necessary for the successful operation of all mechanical systems.

1.5 CODES:

A. Where Standards or Codes are mentioned, the latest edition or revision in force shall be followed.

B. Contract Documents shall take precedence when they are more stringent than codes, ordinances, standards, and statutes. Codes, ordinances, standards, and statutes shall take precedence when they are more stringent or conflict with the drawings and specifications.

C. All plumbing work shall be installed as required per all relevant codes. If the Contractor believes the drawings are specifications are contrary to code, they shall stop work and notify the General Contractor and Engineer immediately.

1.6 PERMITS AND INSPECTIONS:

A. Secure and pay for all permits, inspections, tests and fees required for the work to be performed.

B. Upon completion of the work, furnish Inspection Certificates as normally issued in connection with the work.

1.7 DRAWINGS AND SPECIFICATIONS:

A. Schedules shown on Drawings are for convenience and not intended to be a count of equipment, fixtures, etc. Each supplier shall make a separate count of these items and shall be required to furnish the equipment, fixture and materials wherever shown on the drawings but not included in the Schedule.

B. Drawings show arrangement, general design and extent to the systems and are diagrammatic except where in certain cases they are detailed giving exact locations and arrangement.

C. Drawings are not intended to be scaled for rough-in dimensions. Where shop drawings are required for this purpose or field measurements are needed for the installation, they shall be prepared by the installing contractor.

1.8 SUBMITTALS:

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Prior to delivery of any material to the job site, the Contractor shall submit shop drawings for review by the Engineer.

C. Substitutions: See Part 2 of this section.

D. Operating and Maintenance Instructions:

E. Upon completion of all work and tests, instruct the Owner in the operation and maintenance of all components.

F. Furnish sets of written Operation and Maintenance Data per Division 1.

1.9 RECORD DRAWINGS:

A. The CONTRACTOR shall be responsible to maintain a complete and accurate set of marked up drawings during construction per Specification Section 01 33 00. Markups shall record all changes or deviations from the contract drawings.

B. Record drawings shall be delivered to the Engineer after completion of the work as a permanent record of the installation as actually constructed.

1.10 CONTRACTOR RESPONSIBILITY:

A. Each Contractor all be responsible for the safety and good condition of all work and materials in Contract until its completion.

B. Assume entire responsibility for all the materials, workmanship and satisfactory performance of the systems installed. It is not intended to limit or restrict the Contractor to the use of materials and manner of shop fabrication or erection that is not in accord with best standard practice.

C. It is also not intended that the drawings or this specification indicate or specify each item or material which is required to complete a satisfactory installation. Where such items are required and they are considered to be the accepted trade practice to provide same, they shall be considered to be both specified and indicated.

D. The design and construction of all equipment and materials specified herein shall conform in all details with the latest revised codes of the American Society of Mechanical Engineers, the American Standards Association, American Society of Heating, Refrigeration, and Air Conditioning Engineers, and all existing laws, ordinances, and requirements of the State.

1.11 DELIVERY, STORAGE AND HANDLING:

A. Protect all materials and equipment during delivery and during storage on site. Store materials and equipment on suitable blocking to maintain parts clear of the ground and to insure drainage of all rainwater.

1.12 COORDINATION AND COOPERATION:

A. Submit to and obtain from trades concerned, copies of shop drawings and catalog data of work which connects with or affects their work.

B. Make arrangements with other trades as required to properly correlate installation into the overall project.

C. Each Contractor shall be responsible for establishing elevations and routing of piping to correlate the work with other trades.

D. Coordinate location and arrangement of equipment, piping, etc. In case of interferences between various items, or if simplified construction procedures are possible by relocation or changes in arrangement, change may be made if approved by the Engineer in writing.

1.13 PRODUCT WARRANTY:

A. Warranty all labor, materials, and labor for a period of one (1) year from date of final acceptance.

B. Alterations, repairs, or replacement of defects in materials, equipment, and labor shall be borne by the Contractor at the Contractor's expense.

1.14 MAINTENANCE AND SERVICE ACCESSIBILITY:

A. Install equipment and piping to permit service and maintenance to all parts of the systems installed. Minor deviations from the drawings may be made to provide proper accessibility, but any major change will require written approval.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Where more than one type is indicated, selection is Contractor's option or compliance with governing regulations.

B. Size system drain piping as shown or, if not shown, as required to properly drain piping systems, including valves and equipment.

C. Manufacturer's equipment used as basis of design for project is name indicated in specifications for particular type of equipment or application contained in these contract documents. If no manufacturer is listed, basis of design is industry standard indicated.

2.2 MATERIALS, EQUIPMENT AND WORKMANSHIP:

A. All materials shall be new and shall be prepared, fabricated and installed with skill and workmanship as is commonly considered to be the best in the trade involved. Work shall be performed at such times as will be best for the proper conduct of the entire project.

A. The Engineer shall notify the Contractor of rejected or faulty work upon discovery, but this failure to detect omissions or violations of the Contract will not act as a waiver of the right to demand correction of defects in materials or workmanship.

2.3 SUBSTITUTION OF MATERIALS AND EQUIPMENT:

A. Certain materials and equipment are specified by manufacturer or trade name and catalog or model number to establish standards of quality, performance, design and suitability for intended use. The products of other manufacturers may be authorized by the Engineer if they are equal to those specified as determined by the Engineer and so approved in writing by the Engineer.

B. If the provides equipment or materials listed in the specifications as "equal" or otherwise obtains written approval from the Engineer for a product substitution that is different from the listed Design Basis or specified equipment manufacturer and model number, it shall be the Contractor's responsibility to coordinate its installation with the work of all other trades and with the space available. The Contractor shall also pay for any changes caused to other trades as a result of the substitution.

2.4 EQUIPMENT SUPPORTS:

A. Provide the supports and hangers for equipment installed under this work. Where equipment is to be suspended from the roof steel, provide intermediate support members such that the load is carried at the panel points of the joists or trusses.

2.5 COMPONENTS AND REVISIONS:

A. Components normally furnished with equipment shall be considered as part of the specification whether specifically mentioned or not. Any revision necessary due to substitution shall be the responsibility of the Contractor without extra cost to the project.

PART 3 – EXECUTION

3.1 EXAMINATION OF PREMISES:

A. Verify site conditions under which this work must be conducted prior to commencing. Contractor shall be held to have examined the premises and shall be satisfied and fully conversant with all conditions. No claim for additional compensation due to Contractor's failure to make this evaluation are allowed.

B. Examine all spaces, surfaces, and areas to receive the work. Do not proceed until corrections, if any required, have been made.

C. Verify dimensions, elevations, grades and obtain all measurements required for proper execution of the work.

D. Verify points of connections to utilities prior to start of construction and report any inconsistency before commencing work.

3.2 INSTALLATION REQUIREMENTS:

A. Each sub-contractor shall have in charge of work a competent, experienced superintendent who shall be qualified for the work to be performed.

B. Coordinate and schedule the work with other trades to properly expedite the completion of the project. Consult with other trades so that they are informed for coordination of all services.

C. Equipment shall be set in place when necessary prior to enclosing the spaces. Any equipment that will not enter the normal openings provided or which will not fit into the designated areas will not be acceptable.

D. Equipment shall be cleaned, aligned to tolerances specified by equipment manufacturer, and lubricated prior to start-up. Flush piping, valves, strainers, and similar devices. Adjust systems for proper operation.

E. Perform system adjustments and place all equipment in operating condition. Obtain the services of approved factory trained technicians where specified in this Division to start the equipment in accordance with factory recommendations.

3.3 LUBRICATION:

A. Motors, fans, compressors, pumps, or other equipment which depend upon lubrication shall be properly lubricated in accordance with manufacturer's instructions by Contractor.

B. Lubrication shall be done prior to making any test runs or turning on any equipment.

C. Extend grease fittings on bearings to points of ready and easy accessibility.

3.4 CLEARANCES AND MAINTENANCE ACCESS:

A. Mechanical equipment shall be installed so that maintenance and replacement can be performed without the removal of other equipment.

B. Clearance around pumps, coils, fans, air conditioners, etc., shall be provided for operation, maintenance, replacement, repair and removal.

C. Piping connections to equipment shall be made with valves, unions, or flange fittings to permit their repair or removal without causing damage to piping or equipment.

D. Install all ducts, piping, conduit, wiring, switches, panels, fixtures, etc., to accommodate any obstacles anticipated or encountered during construction. Determine exact route and location of ductwork, piping or raceway prior to fabrication.

E. Prior to shop fabrication of ductwork, piping, conduit, etc., make field measurements and make shop drawings to check for clearances and interferences.

F. Due to the scale of drawings, all required fittings, offsets, elevation changes, and routing are not shown. The intent of these drawings and specifications is that these shall be installed without additional cost.

G. Maintain proper headroom and pitch of lines.

3.5 OPENINGS:

A. Provide openings in walls, ceilings, floors or roofing which are part of the existing construction as required for the installation of the work.

B. The location and size of all openings shall be the responsibility of each sub-contractor for the trade involved.

C. Install and provide sleeves, inserts, panels, raceways, boxes, curbs, etc., ahead of the work to be performed.

D. Openings shall be neatly patched after installation of the work.

E. Flash and counterflash where mechanical equipment passes through waterproofed walls, floors, and roofs.

3.6 CUTTING AND PATCHING:

A. Cutting shall be avoided whenever possible, but any cutting required in the new construction shall be performed by the Contractor under the direction of the General Contractor.

B. Where piping, ductwork, conduit, etc. must pass through walls, floors or other building components, the Contractor shall provide reinforcement or support adjacent to the opening to compensate for the removal of any support material.

3.7 GENERAL CLEANING:

A. Upon completion of the work, leave all surfaces broom clean and vacuum all ductwork, piping, conduit external surfaces.

B. The entire installation shall be thoroughly free from oil and grease, dust and dirt, and any other foreign matter.

C. Special cleaning methods shall be described in individual sections of this specification.

3.8 REMOVAL OF RUBBISH:

A. Remove on a daily basis all rubbish, debris, dirt, cartons, materials, etc., resulting from the work. Remove during construction to keep dirt accumulation to a minimum.

3.9 PROTECTION:

A. Protect all work from damage and protect the Owner's property from injury or loss during the performance of the work.

B. Properly protect adjacent property as provided by law and the contract documents. Provide and maintain all passageways, guard fences, lights and other facilities for protections required by local conditions.

C. Any damage shall be repaired to original condition and acceptable to the Owner.

3.10 LEAK DAMAGE:

A. Damage caused by leaks in any of the equipment or piping installed by the Contractor to the building or to the work of other Contractors or to the contents, etc., shall be repaired by the Contractor who caused such damage at the Contractor's expense.

3.11 DEMONSTRATION TO OWNER AND ENGINEER:

A. After all plumbing systems have been successfully started up and commissioned and all startup reports and commissioning documents have been submitted but prior to Owner Training, the Plumbing Contractor shall meet with the Owner and Engineer to demonstrate in the field that all plumbing systems are operating as intended.

B. See Sections 01 75 00 - Facility Startup, Commissioning and Demonstration and Section 22 08 00 - Commissioning of Plumbing Systems for additional requirements.

3.12 PROJECT CLOSEOUT DOCUMENTS:

A. Provide closeout documents as described in Section 01 78 00.

END OF SECTION

SECTION 22 01 00
BASIC MATERIALS AND METHODS – PLUMBING

PART 1 – GENERAL

1.1 SECTION INCLUDES:

A. Work of this Section includes plumbing piping, equipment, piping supports, piping specialties, valves, and related items for plumbing.

1.2 RELATED SECTIONS:

A. Section 22 00 00 - Plumbing General Provisions.

B. Section 22 07 00 - Insulation – Plumbing.

C. Section 22 40 00 - Plumbing Fixtures.

1.3 SUBMITTALS:

A. Submit under provision of Section 01 33 00.

B. Submit product data information on:
1. Sinks and Trim
2. Gas Turrets

C. Shop drawings for pipe hangers.

1.4 APPLICABLE CODES AND REGULATIONS:

A. Michigan Plumbing Code – 2015.

B. Piping installation and testing shall be per applicable sections of the national standards:
1. Building Services Piping: ASME/ANSI B31.9.
2. Plumbing Systems: ASME/ANSI A112.1.2, A112.6.1M, A112.14.1, A112.18.1M, A112,19.1M, A112.19.2M, A112.19.3M, A112.19.4M, A112.19.5, A112.19.7M, A112.19.8M, A112.21M, A112.21.2.2M, A112.21.3M, A112.26.1M, and A112.36.2M.

C. In addition to ASME/ANSI standards, flammable and combustible liquids and liquid and gas fuel piping installation and testing should be per applicable factory mutual guidelines, local, state and national fire protection codes.

D. Weld design and welder qualification shall be per ASME-Boiler and Pressure Vessel Code, Section IX - "Welding and Brazing Qualifications".

PART 2 – PRODUCTS

2.1 DOMESTIC COLD WATER SYSTEM:

A. Piping:
1. Above Ground Interior 2 Inches and Smaller: Type "L" hard drawn, seamless, copper tubing, conforming to ASTM B88. Fittings shall be sweat type wrought copper, ANSI B16.22. Tees formed into mains are not allowed.

B. Water Hammer Arresters:
1. Size according to the fixture unit method as determined by the Plumbing and Drainage Institute.
2. Acceptable Manufacturers: Josam, Smith, Wade, Zurn or equal.

2.2 DOMESTIC HOT WATER SYSTEM:

A. Piping:
1. Above Ground Interior 2 Inches and Smaller: Type "L" hard drawn, seamless, copper tubing, conforming to ASTM B88. Fittings shall be sweat type wrought copper, ANSI B16.22. Tees formed into mains are not allowed.

2.3 SOIL & WASTE PIPING SYSTEM:

A. Piping:

Above grade soil and waste lines and vent lines, cast iron soil pipe, PVC, galvanized steel pipe, or DWV industrial drainage pipe.

a) Drain, Waste, & Vent (DWV) Pipe: Shall be solvent-cement joint PVC pipe conforming to ASTM D2729. DWV fittings shall conform to ASTM D3311.

2.4 LABORATORY WASTE AND VENT PIPING:

A. Plenum Rated Waste and Vent Piping:

1. Pipe and fittings shall be IAPMO listed Schedule 40 FR-PVDF as manufactured by IPEX or equal by FUSEAL to include pipe supplied in 10 ft lengths and matched fittings, traps and neutralization tanks. It shall also include manufacturer recommended adapters to connect to other piping materials where required.
2. Pipe and fittings shall be made from Kynar 740-02 flame retardant PVDF conforming to ASTM F 1673 with a limiting oxygen index (LOI) of 60. Resin must have a vertical burn rating of 94 V-O. Kynar 740-02 resin shall have surface burning characteristics greater than or equal to a flame spread of 5 and smoke development of 35 per ASTM E84 (UL 723).
3. Fittings shall be Plenumline or approved equal as determined by the engineer prior to bid. Fittings shall be third party certified to ASTM F 1673 and ASTM E84, and IAPMO approved, be of all plastic construction and a tapered elastic retaining ring shall be designed to lock into a machined groove on the mating piping. All fittings shall have integrally molded union connections. No metallic grab rings or clamps shall be allowed.

B. For piping below in cabinet spaces and walls:

1. LabLine Pipe and fittings shall be IAPMO listed Schedule 40 FR-PVDF as manufactured by IPEX or equal by FUSEAL to include pipe supplied in 10 ft lengths and matched fittings, traps and neutralization tanks. It shall also include manufacturer recommended adapters to connect to other piping materials where required.
2. Studor Chem Vent air admittance valve for island venting only.

C. Testing with compressed air is prohibited.

D. Install and provide supports per manufacturers recommendations and requirements.

E. Acid Waste Neutralizer Tank:

1. HDPE Neutralization tank, 200 gallon capacity, as supplied by IPEX. Tank shall have 4" inlet and outlet FPT connections to connect to laboratory waste pipe and 2" vent. Provide with limestone chips and install per manufacturer recommendations and requirements.

F. Acid Waste Floor Drains:

1. IPEX Floway Polypropylene 4" floor drain with adjustable strainer and threaded outlet to connect with IPEX Plenumline fittings with acid resistant trap seal.

PART 3 – EXECUTION

3.1 INSTALLATION:

A. CONTRACTOR shall provide survey to locate pipes, elevations, ducts, conduits, etc. and to prepare shop drawings. Variations to suit existing conditions, structural features or mechanical equipment shall be CONTRACTOR'S responsibility.

B. Run piping parallel with building lines and as direct as possible. Piping shall be concealed as far as possible in the finished portions of the building.

C. Downfeed runouts for water piping shall be taken at 45 degrees or from bottom of main and upfeed runouts from the top of the main.

D. Cut pipe accurately and install without springing or forcing. All burrs shall be removed after cutting.

E. Install plumbing to applicable code requirements.

F. Install gate valves on all branches serving two or more outlets close to the point where the branches leave the main.

G. Provide shut-off valves and access doors for all piping installed in chases.

H. Install all supply piping for fixtures through the sidewalls unless otherwise noted on drawings.

I. Install shock absorbers on the water supply at flush valves or self-closing valves and at equipment with solenoid valves.

J. Install above ground water piping so as to be completely drainable with stop and drain valves installed accessibly at the low points of the system.

K. Lubricate cleanout plugs with mixture of graphite and linseed oil.

L. Install shut-off valves for all fixtures and equipment.

M. Pitch Lines to Drip Legs. Where gas piping is run in a concealed space, provide ventilation grilles as required.

N. Sanitary and storm lines sizes 3 inch and larger graded 1/8 inch per foot unless otherwise indicated. Sanitary lines smaller than 3 inch graded 1/4 inch per foot unless otherwise indicated.

3.2 PIPE AND FITTINGS:

A. Preparation: Ream pipes and tubes, clean off scale and dirt, inside and outside, before assembly. Remove welding slag or other foreign material from piping.

B. Make screwed joints with full cut standard taper pipe threads with red lead and linseed oil or other approved non-toxic joint compound applied to male threads only.

C. Use main sized saddle type branch connections or directly connecting branch lines to mains in steel piping if main is at least one pipe size larger than the branch for up to 6 inch mains and if main is at least two pipe sizes larger than branch for 8 inches and larger mains. Do not project branch pipes inside the main pipe.

D. Provide neoprene gasketing system for cast iron bell and spigot pipe joints.

E. Make steel pipe connections to equipment and branch mains with unions.

F. Provide non-conducting type connections wherever jointing dissimilar metals in open systems. Brass adapters and valves are acceptable.

G. Install pipe per manufacturer's instructions.

H. Use grooved mechanical couplings and mechanical fasteners only in accessible locations.

I. Make connections to equipment and branch mains with unions.

J. Provide non-conducting type connections wherever jointing dissimilar metals in open systems. Brass adapters and valves are acceptable.

3.3 FLASHING:

A. Flash and counterflash where mechanical equipment passes through weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 12 inch minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inch minimum clear on sides with minimum 24 inch sheet size. For pipes through outside walls turn flange back into wall and caulk.

C. Flash floor drains over finished areas with lead 10 inch clear on sides with minimum 36 inch x 36 inch sheet size. Fasten flashing to drain clamp device.

3.4 SLEEVES:

A. Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves. Core drilling is allowed up to 8" openings, with permission of ENGINEER.

B. Install seals and provide floor plate.

C. Size sleeves large enough to accommodate the pipe and covering. Wall sleeves to be flush on both sides and floor sleeves shall extend 1-inch above floor level. Where escutcheon plates are required, extend sleeves 1/4 inch above floor.

D. Where piping passes through floor, ceiling, or wall where no potential moisture exists, close off space between pipe and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.

E. Use modular mechanical type seal for the annular space between pipes and sleeves to seal against water or earth.

F. Install chrome plated escutcheons where piping passes through finished surface.

G. Gravity Systems:
1. Entire System: Close all openings except the highest and fill system with water to point of overflow.
2. Sections: Close all openings except highest and provide a head of 10 feet. In testing successive sections, at least the upper 10 feet of next preceding section shall be included so that every joint and pipe in the whole system (except the uppermost 10 feet) shall have been subjected to a head of 10 feet of water.
3. After system or section under test has been filled with water, wait at least 15 minutes before starting inspection.
4. After 2 hours (minimum) there shall be no evidence of leakage.
5. Test waste, drain and vent pipe system before fixtures are installed and retest after fixtures have been installed.

3.5 CLEANING OF PIPING SYSTEMS:

A. Domestic Water: Flush with chlorine solution - AWWA C651 "Disinfecting Water Mains".

B. Compressed Air and Natural Gas: Blow clear of chips and scale with 100 psig air.

3.6 PIPE IDENTIFICATION:

A. Label all piping showing contents and direction of flow per ANSI/ASME A13.1.

B. Verify label and text colors with Owner so as to match existing labeling scheme.

C. Place label adjacent to each valve and branch takeoff, at each side of a wall or partition through which pipe passes, adjacent to all changes of direction and at 25 feet 0 inch spacing on straight runs.

D. Labels shall be provided as follows:

Outside Pipe Diameter (Including Insulation)	**Minimum Length of Label Color Field**	**Minimum Letter Height**
0.75 - 1.25 inches	8 inches	0.5 inches
1.5 - 2 inches	8 inches	0.75 inches
2.5 - 6 inches	12 inches	1.25 inches
8 - 10 inches	24 inches	2.5 inches
Larger than 10 inches	32 inches	3.5 inches

E. Label Manufacturers: Seton Identification Products, Brady, Topflight Corporation, or equal.

3.7 EQUIPMENT IDENTIFICATION:

A. Provide equipment nameplates in a style, size and color to match existing Owner scheme.

B. Verify equipment naming scheme and desired nameplate types with Owner.

C. If no existing Owner identification scheme exists, provide at a minimum a 2 x 4 inch engraved plastic laminate plate.

3.8 EQUIPMENT MOTORS:

A. Provide motors with all motor driven equipment, complete with drives and controls. Electrical starters will be provided by electrical trade unless part of packaged equipment. See equipment specifications.

B. Unless stated otherwise, all motors shall be TEFC type.

C. Motor Type: Ball-bearing, adequately sized, NEMA rated, with open drip-proof frames and Class B insulation (unless otherwise noted).
1. Less than 1/2 HP: 115 volt, single phase, 60 Hertz.

D. Electrical apparatus provided with motor driven equipment:
1. Completely wired except for external connections. Securely attach to equipment.
2. Conform to requirements of Division 26 for electrical equipment.

END OF SECTION

SECTION 22 07 00
INSULATION – PLUMBING

PART 1 – GENERAL

1.1 SUMMARY:

A. This section includes the furnishing and installation of thermal insulation for plumbing piping as indicated on the drawings, as specified herein, and as required for the proper and complete performance of the work.

B. Types of mechanical insulation specified in this Section include the following:
1. Piping Systems Insulation:
a. Fiberglass.
b. Flexible Elastomeric.
c. Flexible Polyolefin/Polyethylene.

1.2 Related Sections: The following Sections contain requirements that relate to this Section:

A. Section 01780 – Firestopping - For installation of firestopping materials at locations where insulated mechanical items penetrate fire-rated barriers; not work of this Section.

B. Section 22 00 00 – Plumbing General Provisions.

C. Section 22 01 00 – Basic Materials and Methods – Plumbing.

1.3 SUBMITTALS:

A. Submit under provisions of Section 01 33 00.

B. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, r-factor, and furnished accessories for each mechanical system requiring insulation.

1.4 QUALITY ASSURANCE:

A. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulation's similar to that required for this project.

B. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E84 (NFPA 255) method and U.L. 723. Shipping containers for insulating materials shall bear the U. L. label.
1. Exception: Outdoor mechanical insulation may have flame spread index of 75 and smoke developed index of 150.
2. Exception: Industrial mechanical insulation that will not affect life safety egress of building may have flame spread index of 75 and smoke developed index of 150.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

1.6 WARRANTY:

A. Warrant replacement insulation installation for 1 year from date of final acceptance at no additional cost to Owner.

PART 2 – PRODUCTS

2.1 PIPING INSULATION MATERIALS:

A. Subsequent references by name/model number to specific manufacturer's products are intended to indicate level of quality only.

B. Fiberglass: Provide 1-piece, preformed, rigid molded fibrous glass, 4-lb density, with k-factor of 0.24 at 75° F complying with ASTM C547, rated for use to 850° F; with factory-applied, self sealing lap vapor barrier jacketing complying with ASTM C921.
   1. Subject to compliance with requirements, provide products by one of the following:
      a. Knauf Fiberglass GmbH.
      b. Manville.
      c. Owens-Corning Fiberglas Corporation, "SSL-II."

C. Flexible Elastomeric: Provide preformed or sheet material as required complying with ASTM C534. Pre-slit tubular material with factory installed adhesive system is also acceptable.
   1. Subject to compliance with requirements, provide products by one of the following:
      a. Armacell International S.A., "AP ARMAFLEX" or "SELF-SEAL."
      b. Halstead Industrial Products.

D. Flexible Polyolefin/Polyethylene: Provide preformed, pre-slit tubing with factory installed adhesive system as required complying with ASTM C534.
   1. Subject to compliance with requirements, provide products by one of the following:
      a. Armacell International S.A., “SSA” or “TUBOLIT.”
      b. Imcoa, "IMCOLOCK."

E. Insulation on Cold Fittings: Insulate fittings 3 inches and smaller with flexible fiberglass blanket compressed to the thickness of the adjacent insulation. Finish with a skim coat of approved insulating cement, glass fabric and approved vapor barrier mastic. For larger than 3 inches, insulate with flexible fiberglass blanket or mitered segments of fiberglass pipe insulation and finish as above.

F. Piping Insulation Accessories: Provide staples, bands, wires, and cement as recommended by insulation manufacturer for applications indicated.

G. Piping Insulation Compounds: Provide adhesives, sealers, and protective finishes as recommended by insulation manufacturer for applications indicated. Adhesives shall be waterproof.
   1. Adhesives:
      a. Benjamin Foster.
      b. Childers.
      c. Marathon Corporation.

PART 3 – EXECUTION

3.1 EXAMINATION:

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF PIPING INSULATION:

A. Install insulation products as specified herein; and in accordance with manufacturer's written instructions, and recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

C. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

D. Provide exposed insulated ducts and piping with a finish suitable for a final coat of paint. Concealed insulation will not be painted.

E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage. Stapling of vapor barrier jackets on cold piping will be permitted only if the staples

are sealed with an approved vapor barrier mastic of vapor barrier tape. Maintain the vapor barrier seal throughout each system.

F. Extend piping insulation and vapor barrier without interruption through walls, floors and similar piping penetrations, except where otherwise indicated or prohibited by code. Coordinate with firestopping Installer for piping through-penetrations at fire-rated barriers.

G. Continue pipe covering for all insulated cold piping through all hangers and sleeves, with protective metal shield at each hanger, and with 12-inch section of covering material at each hanger of sufficient density to avoid crushing the insulation and damage to vapor barrier. As an option, provide wood blocking or dowel inserts at hangers in place of extra dense covering material.

H. For hot pipes, apply 3-inch wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3-inch wide vapor barrier tape or band. Seal exposed ends of cold piping insulation with vapor barrier mastic.

I. Taper covering terminated at equipment, specialties, access doors, etc., or where jackets are pierced by metal parts such as hangers, thermometers, etc. and securely seal jacket to pipe or other metal parts..

3.3 EXISTING INSULATION REPAIR:

A. Remove and replace damaged sections of existing mechanical insulation, both previously damaged or damaged as part of the Work. Install new insulation of same thickness as existing. Install new jacket lapping and sealed over existing.

3.4 PROTECTION AND REPLACEMENT:

A. Insulation Installer shall advise CONTRACTOR of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

B. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

C. Remove and replace all insulating materials on which mold or mildew has occurred, or which have been discolored or stained due to mold, mildew or condensation within 1 year of Substantial Completion.

3.5 SCHEDULES:

A. General: Insulation thickness, unless otherwise specified, shall comply with ASHRAE Standard 90A.

B. Piping:

1. Plumbing Piping Items Not Insulated: Chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, flow regulators, drainage piping located in crawl spaces or tunnels, buried potable cold water piping, and pre-insulated equipment.
2. Heated Piping Insulation Schedule: Minimum insulation thickness for the following pipe sizes.

Service	**Pipe Sizes (inches)**			
	1 & less	**1 – 1-1/4**	**1-1/2 – 4**	**5 – 8**
Domestic Hot Water	1	1	1.5	1.5

3. Cold Piping Insulation Schedule: Minimum insulation thickness for the following pipe sizes.

Service	Pipe Sizes (inches)			
	1 & less	**1 – 1-1/4**	**1-1/2 – 4**	**5 & 6**
Domestic Cold Water	1	1	1	1
	1	1	1	1

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 – GENERAL

1.1 DESCRIPTION:

A. The work of this Section includes plumbing fixtures, water heaters, and related trim.

1.2 SUBMITTALS:

A. Submit under provisions of Section 01 33 23.

B. Submit product data for all fixtures, faucets, p-traps, trim, and auxiliaries.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Lab Sinks are to be provided by the Lab Furniture Manufacture. All sink trim shall be by Water Saver including gas and vacuum turrets.

B. Fixtures for entire project shall be product of one manufacturer. Fittings of same type shall be product of one manufacturer.

PART 3 – EXECUTION

3.1 INSTALLATION:

A. Install each fixture with its own trap, easily removable for servicing and cleaning. At completion, thoroughly clean plumbing fixtures and equipment.

B. Provide chrome plated rigid or flexible supplies to fixtures with screwdriver stops, reducers and escutcheons.

C. Mount fixtures as indicated on Architectural drawings.

END OF SECTION

SECTION 23 00 00
MECHANICAL GENERAL PROVISIONS

PART 1 – GENERAL

1.1 GENERAL PROVISIONS:

A. General:
1. "Provide" means furnish and install.
2. The provisions of this Section shall apply to other work specified in this Division 23 - Mechanical.
3. Although the drawings attempt to depict ductwork, piping and equipment as installed, actual conditions and locations of existing may differ from that which is shown. Field verify actual conditions prior to bid.
4. Field mark and then verify all demolition work with Owner prior to commencing work.
5. Coordinate shutdown of all utilities with Owner prior to shutdown. Temporary shut-down and tie-ins may be required during special off-hour periods.
6. Submit equipment and product submittals to the Architect/Engineer for approval prior to construction.

1.2 CONSTRUCTION REQUIREMENTS:

A. The Mechanical Contractor shall carefully coordinate with the Construction Manager and Owner regarding the operation and maintenance and possible temporary shutdown of existing HVAC and piping systems that may adversely affect or be adversely affected by the new construction.

1.3 MECHANICAL WORK SCOPE SUMMARY:

A. General:
1. Furnish all materials, supplies, equipment, tools, transportation and facilities, and perform all labor and services necessary for the complete installation of the mechanical systems as shown on the Drawings, as herein specified, and as required to make complete and operating systems.

B. Demolition:
1. Remove existing laboratory fume hood and integral exhaust fan including cup sink and associated cold water and waste piping. Natural gas and vacuum piping. Cap all piping below floor and main.

C. New Work:
1. General Laboratory: Serving new Fume Hood
a. Provide new packaged roof top unit complete with DX cooling, indirect gas heating complete with insulated roof curb.
b. Provide a new roof mounted polyethylene exhaust fan complete with weather cap and curb.
c. Provide new plastic (pvc) exhaust duct from exhaust fan to lab hood connection
d. Provide new natural gas supply (paint to match existing) to RTU and supply air duct work with roof curb for duct penetration.
e. Provide temperature controls system for complete and operational system.

1.4 INTENT:

A. The intent of this Division is to call for finished work, tested and ready for operation.

B. Furnish all materials, supplies, equipment, tools, transportation and facilities, and perform all labor and services necessary for the complete installation of the mechanical systems as shown on the Drawings, as herein specified, and as required to make complete and operating systems.

C. The work shall also include the completion of such details of mechanical work not mentioned or specifically shown, but which are necessary for the successful operation of all mechanical systems.

1.5 CODES:

A. Where Standards or Codes are mentioned, the latest edition or revision in force shall be followed.

B. Contract Documents shall take precedence when they are more stringent than codes, ordinances, standards, and statutes. Codes, ordinances, standards and statutes shall take precedence when they are more stringent or conflict with the drawings and specifications.

C. All mechanical work shall be installed as required per all relevant codes. If the Contractor believes the drawings are specifications are contrary to code, they shall stop work and notify the General Contractor and Engineer immediately.

1.6 PERMITS AND INSPECTIONS:

A. Secure and pay for all permits, inspections, tests, and fees required for the work to be performed.

B. Upon completion of the work, furnish Inspection Certificates as normally issued in connection with the work.

1.7 DRAWINGS AND SPECIFICATIONS:

A. Schedules shown on drawings are for convenience and not intended to be a count of equipment, fixtures, etc. Each supplier shall make a separate count of these items and shall be required to furnish the equipment, fixture and materials wherever shown on the drawings but not included in the Schedule.

B. Drawings show arrangement, general design and extent to the systems and are diagrammatic except where in certain cases they are detailed giving exact locations and arrangement.

C. Drawings are not intended to be scaled for rough-in dimensions. Where shop drawings are required for this purpose or field measurements are needed for the installation, they shall be prepared by the installing contractor.

1.8 SUBMITTALS:

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings: Prior to delivery of any material to the job site, the Contractor shall submit shop drawings for review by the Engineer.

C. Substitutions: See Part 2 of this section.

D. Operating and Maintenance Instructions:
1. Upon completion of all work and tests, instruct the Owner in the operation and maintenance of all components.
2. Furnish sets of written Operation and Maintenance Data per specifications in Division 1.

1.9 RECORD DRAWINGS:

A. The CONTRACTOR shall be responsible to maintain a complete and accurate set of marked up drawings during construction per Specification Section 01 33 00. Markups shall record all changes or deviations from the contract drawings.

B. Record drawings shall be delivered to the Engineer after completion of the work as a permanent record of the installation as actually constructed.

1.10 CONTRACTOR RESPONSIBILITY:

A. Each Contractor all be responsible for the safety and good condition of all work and materials in Contract until its completion.

B. Assume entire responsibility for all the materials, workmanship and satisfactory performance of the systems installed. It is not intended to limit or restrict the Contractor to the use of materials and manner of shop fabrication or erection that is not in accord with best standard practice.

C. It is also not intended that the drawings or this Specification indicate or specify each item or material which is required to complete a satisfactory installation. Where such items are required and they are considered to be the accepted trade practice to provide same, they shall be considered to be both specified and indicated.

D. The design and construction of all equipment and materials specified herein shall conform in all details with the latest revised codes of the American Society of Mechanical Engineers, the American Standards Association, American Society of Heating, Refrigeration, and Air Conditioning Engineers, and all existing laws, ordinances, and requirements of the State.

1.11 DELIVERY, STORAGE AND HANDLING:

A. Protect all materials and equipment during delivery and during storage on site. Store materials and equipment on suitable blocking to maintain parts clear of the ground and to insure drainage of all rainwater.

1.12 COORDINATION AND COOPERATION:

A. Submit to and obtain from trades concerned, copies of shop drawings and catalog data of work which connects with or affects their work.

B. Make arrangements with other trades as required to properly correlate installation into the overall project.

C. Each Contractor shall be responsible for establishing elevations and routing of ductwork and piping and to correlate the work with other trades.

D. Coordinate location and arrangement of equipment, piping, ductwork, etc. In case of interferences between various items, or if simplified construction procedures are possible by relocation or changes in arrangement, change may be made if approved by the Engineer.

1.13 WARRANTY:

A. Warranty all labor, materials, and labor for a period of one (1) year from date of final acceptance.

B. Alterations, repairs, or replacement of defects in materials, equipment, and labor shall be borne by the Contractor at the Contractors' expense.

1.14 MAINTENANCE AND SERVICE ACCESSIBILITY:

A. Install equipment, ductwork and piping to permit service and maintenance to all parts of the systems installed. Minor deviations from the drawings may be made to provide proper accessibility, but any major change will require written approval.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Reference applicable technical sections in this Division for specific systems.

2.2 MATERIALS, EQUIPMENT AND WORKMANSHIP:

A. All materials shall be new and shall be prepared, fabricated, and installed with skill and workmanship as is commonly considered to be the best in the trade involved. Work shall be performed at such times as will be best for the proper conduct of the entire project.

B. The Engineer shall notify the Contractor of rejected or faulty work upon discovery, but this failure to detect omissions or violations of the Contract will not act as a waiver of the right to demand correction of defects in materials or workmanship.

2.3 SUBSTITUTION OF MATERIALS AND EQUIPMENT

A. Certain materials and equipment are specified by manufacturer or trade name and catalog or model number to establish standards of quality, performance, design, and suitability for intended use. The

products of other manufacturers may be authorized by the Engineer if they are equal to those specified as determined by the Engineer and so approved in writing by the Engineer.

B. If the provides equipment or materials listed in the specifications as "equal" or otherwise obtains written approval from the Engineer for a product substitution that is different from the listed Design Basis or specified equipment manufacturer and model number, it shall be the Contractor's responsibility to coordinate its installation with the work of all other trades and with the space available. The Contractor shall also pay for any changes caused to other trades as a result of the substitution.

2.4 EQUIPMENT SUPPORTS:

A. Provide the supports and hangers for equipment installed under this work. Where equipment is to be suspended from the roof steel, provide intermediate support members such that the load is carried at the panel points of the joists or trusses.

2.5 COMPONENTS AND REVISIONS:

A. Components normally furnished with equipment shall be considered as part of the specification whether specifically mentioned or not. Any revision necessary due to substitution shall be the responsibility of the Contractor without extra cost to the project.

PART 3 – EXECUTION

3.1 EXAMINATION OF PREMISES:

A. Verify site conditions under which this work must be conducted prior to commencing. Contractor shall be held to have examined the premises and shall be satisfied and fully conversant with all conditions. No claim for additional compensation due to Contractor's failure to make this evaluation are allowed.

B. Examine all spaces, surfaces, and areas to receive the work. Do not proceed until corrections, if any required, have been made.

C. Verify dimensions, elevations, grades and obtain all measurements required for proper execution of the work.

D. Verify points of connections to utilities prior to start of construction and report any inconsistency before commencing work.

3.2 INSTALLATION REQUIREMENTS:

A. Each sub-contractor shall have in charge of work a competent, experienced superintendent who shall be qualified for the work to be performed.

B. Coordinate and schedule the work with other trades to properly expedite the completion of the project. Consult with other trades so that they are informed for coordination of all services.

C. Equipment shall be set in place when necessary prior to enclosing the spaces. Any equipment which will not enter the normal openings provided or which will not fit into the designated areas will not be acceptable.

D. Equipment shall be cleaned, aligned to tolerances specified by equipment manufacturer, and lubricated prior to start-up. Flush piping, valves, strainers, and similar devices. Adjust systems for proper operation.

E. Perform system adjustments and place all equipment in operating condition. Obtain the services of approved factory trained technicians where specified in this Division to start the equipment in accordance with factory recommendations.

3.3 LUBRICATION:

A. Motors, fans, compressors, pumps, or other equipment which depend upon lubrication shall be properly lubricated in accordance with manufacturer's instructions by Contractor.

B. Lubrication shall be done prior to making any test runs or turning on any equipment.

C. Extend grease fittings on bearings to points of ready and easy accessibility.

3.4 CLEARANCES AND MAINTENANCE ACCESS:

A. Mechanical equipment shall be installed so that maintenance and replacement can be performed without the removal of other equipment.

B. Clearance around pumps, coils, fans, air conditioners, etc., shall be provided for operation, maintenance, replacement, repair and removal.

C. Piping connections to equipment shall be made with valves, unions, or flange fittings to permit their repair or removal without causing damage to piping or equipment.

D. Install all ducts, piping, conduit, wiring, switches, panels, fixtures, etc., to accommodate any obstacles anticipated or encountered during construction. Determine exact route and location of ductwork, piping or raceway prior to fabrication.

E. Prior to shop fabrication of ductwork, piping, conduit, etc., make field measurements and make shop drawings to check for clearances and interferences.

F. Due to the scale of drawings, all required fittings, offsets, elevation changes, and routing are not shown. The intent of these drawings and specifications is that these shall be installed without additional cost.

G. Maintain proper headroom and pitch of lines.

3.5 OPENINGS:

A. Provide openings in walls, ceilings, floors or roofing which are part of the existing construction as required for the installation of the work.

B. The location and size of all openings shall be the responsibility of each sub-contractor for the trade involved.

C. Install and provide sleeves, inserts, panels, raceways, boxes, curbs, etc. ahead of the work to be performed.

D. Openings shall be neatly patched after installation of the work.

E. Flash and counterflash where mechanical equipment passes through waterproofed walls, floors, and roofs.

3.6 CUTTING AND PATCHING:

A. Cutting shall be avoided whenever possible, but any cutting required in the new construction shall be performed by the Contractor under the direction of the General Contractor.

B. Where piping, ductwork, conduit, etc. must pass through walls, floors or other building components, the Contractor shall provide reinforcement or support adjacent to the opening to compensate for the removal of any support material.

3.7 GENERAL CLEANING:

A. Upon completion of the work, leave all surfaces broom clean and vacuum all ductwork, piping, conduit external surfaces.

B. The entire installation shall be thoroughly free from oil and grease, dust and dirt, and any other foreign matter.

C. Special cleaning methods shall be described in individual sections of this specification.

3.8 REMOVAL OF RUBBISH:

A. Remove on a daily basis all rubbish, debris, dirt, cartons, materials, etc., resulting from the work. Remove during construction to keep dirt accumulation to a minimum.

3.9 PROTECTION:

A. Protect all work from damage and protect the Owner's property from injury or loss during the performance of the work.

B. Properly protect adjacent property as provided by law and the contract documents. Provide and maintain all passageways, guard fences, lights and other facilities for protections required by local conditions.

C. Any damage shall be repaired to original condition and acceptable to the Owner.

3.10 LEAK DAMAGE:

A. Damage caused by leaks in any of the equipment or piping installed by the Contractor to the building or to the work of other Contractors or to the contents, etc., shall be repaired by the Contractor who caused such damage at the Contractor's expense.

3.11 STARTUP AND COMMISSIONING:

A. The Contractor shall work under the direction of the Engineer, Construction Manager and Owner to properly commission all mechanical systems.

3.12 DEMONSTRATION TO OWNER AND ENGINEER:

A. After all mechanical systems have been successfully started up and commissioned and all startup reports and commissioning documents have been submitted but prior to Owner Training, the Plumbing Contractor shall meet with the Owner and Engineer to demonstrate in the field that all plumbing systems are operating as intended.

B. See Section 01 75 00 - Facility Startup, Commissioning and Demonstration and Section 22 08 00 - Commissioning of Plumbing Systems for additional requirements.

3.13 OWNER TRAINING:

A. After all plumbing systems have been successfully demonstrated to the Owner and Engineer, the Plumbing Contractor shall provide Owner Training to the Owner's maintenance staff at both Substantial Completion and Final Completion.

B. See Section 01 79 00 – Owner Training for requirements.

3.14 PROJECT CLOSEOUT DOCUMENTS:

A. Provide closeout documents as described in Section 01 78 00.

END OF SECTION

SECTION 23 01 00
BASIC MATERIALS AND METHODS - HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Basic materials and methods and related items for HVAC.

1.2 SUBMITTALS:

A. Submit under provisions of Section 01 33 00.

B. Product Data for the following HVAC related items:
1. Roof top unit and accessories.
2. Exhaust fan and accessories.
3. Supply and Exhaust ductwork systems.
4. Insulation.

C. Miscellaneous
1. Proposed system testing procedures and dates
2. Proposed valve schedules
3. Results of all pressure and chemical tests
4. Commissioning Checklists – See Section 23 08 00.

1.3 RELATED SECTIONS:

A. Section 23 00 00 – HVAC General Requirements

B. Section 23 05 90 – Testing, Adjusting, and Balancing

C. Section 23 07 00 – HVAC Insulation

D. Section 23 08 00 – Commissioning of HVAC Systems

E. Section 23 09 90 – Sequences of Operation and Graphics

F. Section 23 30 00 – Ductwork and Ductwork Accessories

G. Section 23 34 00 – Fans and Power Ventilators

H. Section 23 37 00 – Air Inlets and Outlets

PART 2 PRODUCTS

2.1 NATURAL GAS SYSTEM:

A. Piping:
1. Interior Above Ground 2" and Smaller: Black steel pipe, electric resistance welded, conforming to ASTM A53, Type E, Grade B, Schedule 40, with screwed joints and 125-pound fittings. Elbows to be long radius design.
2. Exterior Above Ground: Pipe shall meet specifications for interior piping above. All exterior gas piping above grade shall be painted safety yellow with the following material and marked "Natural Gas":
a. First Coat: Epoxy Mastic 5 mils D.F.T.
1) International: Interseal 670HS.
2) Carboline: Carbomastic 15.
3) MAB: 101-044 Line Plymastic.
4) I.C.I. Dulux: 224H-XXXX Devron 224 HS Epoxy High Build Coating.
b. Second Coat: Urethane 2.0 mils D.F.T.
1) International: Interthane 990HS.
2) Carboline: Carboline 834.
3) MAB: Plythane 890HS Coating.
4) I.C.I. Dulux: 224H-XXXX Devron 224 HS Epoxy High Build Coating.

5. Exterior Underground: Black steel pipe with plastic X-Tru-Coat pipe coating. Pipe shall meet specifications for interior piping above.

B. Gas Shut-Off Cocks:
1. 4 Inch and Smaller with Operating Lever: DeZurik No. 400, Crane No. 320, or equal.
2.

2.2 PIPE HANGERS AND SUPPORTS:

A. Hanger material shall be the same as the piping material. No exceptions.

B. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inch: Adjustable wrought steel ring.

C. Hangers for Pipe Sizes 2 Inches and Above: Adjustable clevis hanger.

D. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches and Cold Pipe Sizes 6 Inches and Over: Adjustable wrought steel clevis.

E. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke and cast iron roll.

F. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods, cast iron roll and stand for hot pipe size 6 inches and over.

G. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

H. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp, adjustable steel yoke and cast iron roll for hot pipe sizes 6 inches and over.

I. Vertical Support: Steel riser clamp.

J. Floor Support for Pipe Sizes to 4 Inches and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and concrete pier to steel support.

K. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws and concrete pier or steel support.

L. Design hangers to impede disengagement by movement of supported pipe.

M. Provide copper plated hangers and supports for copper piping or provide sheet lead packing between hanger or support and piping.

N. Acceptable Manufacturers: Anvil, B-Line, Fee and Mason, or approved equal.

2.3 PIPE SLEEVES:

A. For pipes that pass through the building, both below and above grade:
1. Modular Mechanical Type Seal: Use LINKSEAL type pipe sleeves for the annular space between pipes and sleeves to seal against water or earth, consisting of interlocking synthetic rubber links compressed to positive seal by through bolts bearing on reinforced nylon polymer plastic pressure plates. Provide 316 stainless steel bolts

B. For pipes passing between non-fire rated walls:
1. Material: Seamless pipe, galvanized, ASTM A53 Large enough to accommodate the pipe and its covering, wall sleeves to be flush on both sides, and floor sleeves to be extended 1 inch above floor level. Where escutcheon plates are required, extend the sleeves 1/4 inch above the floor.

2.4 BALL VALVES:

A. Ball Valve: Full port ball valve, selected for intended service. See Schedule.

2.5 MISCELLANEOUS SMALL VALVES:

A. This section applies to all valves on mechanical piping.

B. Refer to valve Schedule.

2.6 FLEXIBLE PIPE CONNECTIONS:

A. Steel Piping: Construct with stainless steel inner hose and braided exterior sleeve.

B. Copper Piping: Construct with bronze inner hose and braided exterior sleeve.

C. Use connectors suitable for minimum 125 psi and 450° F and 200 psi WOG and 250° F.

D. Flexible Couplings for Ductile Iron Pipe for Air or Water Service: Rubber tube, neoprene cover, expansion, spool type joints.

E. Manufacturers: Universal, Flexonics and Metraflex or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Contractor shall provide survey to locate pipes, elevations, ducts, conduits, etc. and to prepare shop drawings. Variations to suit existing conditions, structural features or mechanical equipment shall be Contractor's responsibility.

B. Run piping parallel with building lines and as direct as possible. Piping shall be concealed as far as possible in the finished portions of the building.

C. Provide air relief valves in all high points of heating hot water and chilled water piping.

D. Provide valved end run around loops so that cleaning and passivating chemicals can be circulated in all new hydronic piping systems.

E. Downfeed runouts for water piping shall be taken at 45 degrees or from bottom of main and upfeed runouts from the top of the main.

F. Cut pipe accurately and install without springing or forcing. All burrs shall be removed after cutting.

G. Install shutoff valves on all branches serving two or more outlets close to the point where the branches leave the main.

H. Provide shut-off valves and access doors for all piping installed in chases.

I. Lubricate cleanout plugs with mixture of graphite and linseed oil.

J. Install shut-off valves for all fixtures and equipment.

3.2 PIPE AND FITTINGS

A. Preparation: Ream pipes and tubes, clean off scale and dirt, inside and outside, before assembly. Remove welding slag or other foreign material from piping.

B. Connection: Screw joint steel piping up to and including 2 inches. Weld piping 2-1/2 inches and larger, including branch connections.

C. Make screwed joints with full cut standard taper pipe threads with red lead and linseed oil or other approved non-toxic joint compound applied to make threads only.

D. Use main sized saddle type branch connections or directly connecting branch lines to mains in steel piping if main is at least one pipe size larger than the branch for up to 6 inch mains and if main is at least two pipe sizes larger than branch for 8 inches and larger mains. Do not project branch pipes inside the main pipe.

E. Provide gasket and clamp type mechanical fastener for plain end pipe joints.

F. Use grooved mechanical couplings and mechanical fasteners only in accessible locations.

G. Make connections to equipment and branch mains with unions.

H. Provide non-conducting type connections wherever jointing dissimilar metals in open systems. Brass adapters and valves are acceptable.

3.3 PIPE HANGERS AND SUPPORTS:

A. Support horizontal steel and copper piping as follows:

Nominal Pipe Size (in.)	Max. Distance Between Support (ft.)
1/2 to 1-1/2	6
2 & 2-1/2	10
3 & 4	12
6 to 12	14

B. Install hangers to provide minimum 1/2 inch clear space between finished covering and adjacent work.

A. Place a hanger within one foot of each horizontal elbow.

B. Use hangers which are vertically adjustable 1-1/2 inch minimum after piping is erected.

C. Support vertical piping at every other floor.

D. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

E. Where practical, support riser piping independently of connected horizontal piping.

F. Do not support pipe from other pipe.

3.4 FLASHING:

A. Flash and counterflash where mechanical equipment passes through weather or waterproofed walls, floors, and roofs.

3.5 SLEEVES:

A. Refer to Part 2 – Products for applications

B. Wherever possible, set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.

C. Provide 2 hr rated seals at all pipe penetrations through 2 hr rated fire separation walls.

D. Where piping or ductwork passes through floor, ceiling or wall where no potential moisture exists, close off space between pipe or duct and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.

E. Install chrome plated escutcheons where piping passes through finished surfaces.

3.6 VALVES:

A. General:
1. Provide valves of same manufacturer throughout where possible.
2. Provide valves with manufacturer's name and pressure rating clearly marked on outside of body.

B. Installation:
1. Install valves with stems upright or horizontal, not inverted.

2. Install gate, ball, or plug valves for shut-off and isolating service, to isolate equipment, part of systems or vertical risers.
3 Ball valves on natural gas piping are to be CSA/CGA rated for natural gas shut-off.

C. Miscellaneous Valve Schedule:

Type	Size	Milwaukee Cat. #	Hamm. Cat. #	Crane Cat. #	Nibco Cat. #
Ball Valves	2" and smaller	BA-400	8311a	2330TF	T-585-70

Type	Size	Milliken (Mueller) Cat. #	Nordstrom (Flowserve)	Homestead Cat. #
Plug Valves	2" and smaller	170M	142	611
	2-1/2" and larger	171M	143	612

3.7 TESTING:

A. General:
1. Each system of piping and control tubing tested by installer under superintendence of the Contractor.
2. Provide pumps, gauges, instruments, test equipment personnel and clean auxiliary water. After tests have been made, remove all test equipment and drain all pipes.

B. Test prior to painting, installation and insulation, or concealment.
1. Tests may be made on sections of piping as installed.
2. Re-test repaired or revised piping.

C. Pressure Systems:
1. Domestic hot and cold water, compressed air and natural gas.
2. Testing with compressed air or gas is prohibited except for natural gas and compressed air systems.
3. Test Pressure: 150 percent of the operating pressure or pump shut-off head pressure whichever is greater.
a. Minimum Pressure: 50 psi.
b. Test Period: 2 hours minimum.

D. CLEANING OF PIPING SYSTEMS:

E. Domestic Water: Flush with chlorine solution - AWWA C651 "Disinfecting Water Mains".

F. Compressed Air and Natural Gas: Blow clear of chips and scale with 100 psig air.

3.8 PIPE IDENTIFICATION:

A. Label all piping showing contents and direction of flow per ANSI/ASME A13.1.

B. Verify label and text colors with Owner so as to match existing labeling scheme.

C. Place label adjacent to each valve and branch takeoff, at each side of a wall or partition through which pipe passes; adjacent to all changes of direction and at 25 feet 0 inch spacing on straight runs.

D. Labels shall be provided as follows:

Outside Pipe Diameter (Including Insulation)	Minimum Length of Label Color Field	Minimum Letter Height
0.75 - 1.25 inches	8 inches	0.5 inches
1.5 - 2 inches	8 inches	0.75 inches
2.5 - 6 inches	12 inches	1.25 inches
8 - 10 inches	24 inches	2.5 inches
Larger than 10 inches	32 inches	3.5 inches

E. Label Manufacturers: Seton Name Plate Corporation, W.H. Brady, Topflight Tape Company, James H. Matthews, or equal.

3.9 EQUIPMENT IDENTIFICATION:

A. Provide equipment nameplates in a style, size and color to match existing Owner scheme.

B. Verify equipment naming scheme and desired nameplate types with Owner.

C. If no existing Owner identification scheme exists, provide at a minimum a 2 x 4 inch engraved plastic laminate plate.

3.10 VALVE IDENTIFICATION:

A. Brass Tags: 1 inch diameter, secured to each valve with brass S-hook and stamped with system designation and assigned number.

B. Obtain existing valve schedule from Owner and review existing valve naming sequence. Submit proposed schedule showing proposed continuation of sequence to Architect / Engineer for approval. Provide a printed schedule, in duplicate, describing each valve by number, giving location and service for which used.

3.11 LUBRICATION:

A. Ensure that all motors and equipment, as required, are properly lubricated before such items are accepted by the OWNER.

3.12 COMMISSIONING - GENERAL:

A. Fully startup and commission all systems as described in Section 23 08 00 – Commissioning of HVAC Systems

3.13 EQUIPMENT MOTORS:

A. Provide motors with all motor driven equipment, complete with drives and controls. Electrical starters will be provided by electrical trade unless part of packaged equipment. See equipment specifications.

B. Unless stated otherwise, all motors shall be TEFC type.

C. Motor Type: Ball-bearing, adequately sized, NEMA rated, with open drip-proof frames and Class B insulation (unless otherwise noted).
   1. Less than 1/2 HP: 115 volt, single phase, 60 Hertz.

D. Electrical apparatus provided with motor driven equipment:
   1. Completely wired except for external connections. Securely attach to equipment.
   2. Conform to requirements of Division 26 for electrical equipment.

END OF SECTION

SECTION 23 05 90
TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY:

A. This Section specifies the requirements and procedures for total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of mechanical systems fluid flow rates as required to meet design specifications; and recording and reporting the results of these measurements.

B. Systems testing, adjusting, and balancing (T/A/B) consists of checking and adjusting all building environmental systems to produce design objectives. It includes, but is not necessarily limited to, the following:
1. Balancing of air distribution system.
2. Adjustment of total system to provide design flow rates.
3. Electrical measurements.
4. Assistance with the verification of performance of all equipment and automatic controls.

C. For the chemical fume hood, test and certify the hood performance per NEBB and ASHRAE Standard 110-2016 "Methods of Testing Performance of Laboratory Fume Hoods." Engage the services of a certified professional as required.

D. For**,** rooftop units, perform test and balance activities for the following:
1. Test and record all associated electrical motor data and mechanical fan data including fan size and type, motor model and type, motor HP, voltage, service factor, max amps, actual amps, calculated brake HP, motor RPM, fan RPM, all pulley and belt information, etc.
2. Test and balance all supply air and return air duct systems (including all air inlets and outlets) and OA cfm measurements to verify / confirm specified design flows for each operating mode.
3. Test and record multiple static pressure values and pressure drops at each air handling device or section including fan inlets and outlets, equipment inlets and outlets, across filters, across each coil, across burner sections, etc. Provide a sketch showing the static pressure values at each equipment sections or location from the equipment inlet to the equipment outlet.
4. Verify all filter data including manufacturer, type, sizes, total number of filters, filter condition, etc. for all filters.
5. Confirm accuracy of any unit or duct mounted airflow measuring devices.
6. Coordinate with the Temperature Control Contractor (TCC) and calibrate all temperature and pressure sensors.

E. For, provide test and balance activities for the following:
1. Test and record all associated electrical motor data and mechanical fan data including fan size and type, motor model and type, motor HP, voltage, service factor, max amps, actual amps, calculated brake HP, motor RPM, fan RPM, all pulley and belt information, etc.
2. Test and balance all exhaust and discharge air duct systems (including all air inlets and outlets).
3. Test and record multiple static pressure values at fan inlets and outlets, equipment inlets and outlets, across filters, etc. Provide a sketch showing the static pressure values at each equipment sections or location.
4. Coordinate with the Temperature Control Contractor (TCC) and calibrate all temperature and pressure sensors.
5. Confirm accuracy of any unit or duct mounted airflow measuring devices.

F. Assist with the calibration of all temperature and pressure sensors.

G. Provide test and balance services for the following systems
1. Rooftop Units
   a. RTU-1

2. Rooftop Units including supply air and return air duct systems (including air inlets and outlets) and OA cfm measurements to verify / confirm specified design flows for each operating mode.
   a. RTU-1
3. Exhaust Fans
   a. EF-1

H. Work with the Engineer during commissioning to adjust airflow offset values to achieve desired room pressurization for each renovated room.

1.2 RELATED SECTIONS

A. Section 01 78 00 – Project Record Documents

B. Section 23 00 00 – HVAC General Requirements

C. Section 23 01 00 – Basic Materials and Methods - HVAC

D. Section 23 08 00 – Commissioning of HVAC Systems

E. Section 23 09 20 – Direct Digital Temperature Control and Instrumentation

F. Section 23 09 90 – Sequences of Operation and Graphics

G. Section 23 30 00 – Ductwork and Ductwork Accessories

H. Section 23 37 00 – Air Inlets and Outlets

1.3 SYSTEM PERFORMANCE REQUIREMENTS AND OBSERVED FIELD PROBLEMS

A. Required systems performance: Balance all systems to within 8% of the stated performance values.

B. System Balancing Problems: If it becomes apparent that the various systems cannot be balanced to within 8% of the stated performance values due to some system installation or equipment performance problem, stop work as soon as possible and immediately contact the Architect / Engineer. DO NOT proceed with system balancing and submit a complete report if there are system design or performance problems.

1.4 DEFINITIONS:

A. Test: To determine quantitative performance of equipment.

B. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).

C. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.

D. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.

E. Report Forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

F. Terminal: The point where the controlled fluid enters or leaves the distribution system. These are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.

G. Main: Duct or pipe containing the system's major or entire fluid flow.

H. Submain: Duct or pipe containing part of the system's capacity and serving 2 or more branch mains.

I. Branch Main: Duct or pipe serving 2 or more terminals.

J. Branch: Duct or pipe serving single terminal.

1.5 SUBMITTALS:

A. Submit under provisions of Section 01 33 00 - Submittal Procedures.

B. Sample Forms: Submit sample forms, if other than those standard forms prepared by the AABC are proposed.

C. Certified Reports: Submit T/A/B reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are true representation of how the systems are operating at the completion of the T/A/B procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:

1. Draft Reports: Upon completion of T/A/B procedures, prepare draft reports on the approved forms. Draft reports may be handwritten, but must be complete, factual, accurate, legible, and include flow coefficients and final static and pressure setpoints. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only one complete set of draft reports will be returned.
2. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports.
3. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, 3-ring binders. Provide binding edge labels with the project identification and title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:
   a. General Information and Summary.
   b. Air Systems.
   c. Temperature Control Systems.
4. Report Contents: Provide the following minimum information, forms and data:
   a. General Information and Summary: Inside cover sheet to identify T/A/B agency, Contractor, Owner, Engineer, and project. Include addresses, contact names, and telephone numbers. Also include certification sheet containing the seal and name address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a list of instrumentation used for the procedures along with the proof of calibration.
   b. Remainder of Report: Include appropriate forms containing as minimum, the information indicated on the standard report forms prepared by the AABC, for each respective item and system. Prepare schematic diagram for each item of equipment and system to accompany each respective report form.

D. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within period of 6 months prior to starting the project.

1.6 QUALITY ASSURANCE:

A. Codes and Standards: Perform T/A/B work in accordance with applicable provisions of the following:

1. AABC: National Standards for Total System Balance, 7th edition.
2. ASHRAE: ASHRAE Handbook, 2019 Applications Volume, Chapter 39, Testing, Adjusting, and Balancing.

3. ASHRAE: ASHRAE Standard 111-2008 (RA 2017) Testing, Adjusting, and Balancing of Building HVAC Systems (ANSI Approved)

B. Pre-Balancing Conference: Prior to commencing T/A/B procedures, schedule and conduct conference with the Engineer and representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of system operation and readiness for commencement of T/A/B work.

1.7 PROJECT CONDITIONS:

A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

B. Pre-Balancing Checklist: Prior to beginning T/A/B procedures, survey all systems scheduled to be tested, adjusted, and balanced. Identify all incomplete work, non-functioning systems or missing devices which will prevent effective performance of T/A/B work. Present this information to appropriate mechanical systems installers in checklist form. Do not begin T/A/B work until all checklist items have been satisfactorily addressed.

1.07 SEQUENCING AND SCHEDULING:

A. Test, adjust, and balance the air systems before hydronic systems.

B. Develop and then coordinate and verify the Proposed TAB schedule with the Construction Manager / General Contractor and Engineer / Owner prior to proceeding.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING:

A. Before operating the system, perform these steps:
1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.
2. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.
3. Compare design to installed equipment and field installations.
4. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.
5. Check filters for cleanliness.
6. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
7. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare summation of required outlet volumes to permit crosscheck with required fan volumes.
8. Determine best locations in main and branch ductwork for most accurate duct traverses.
9. Place outlet dampers in the full open position.
10. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.
11. Lubricate all motors and bearings.
12. Check fan belt tension.
13. Check fan rotation.

3.3 MEASUREMENTS:

A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.

B. Provide instruments meeting the specifications of the referenced standards. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.

C. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.

D. When averaging values, take sufficient quantity of readings which will result in repeatability error of less than 5 percent. When measuring single point, repeat readings until 2 consecutive identical values are obtained.

E. Take all reading with the eye at the level of the indicated value to prevent parallax.

F. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.

3.4 PERFORMING TESTING, ADJUSTING, AND BALANCING:

A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.

B. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.

C. Patch insulation, ductwork, and housings, using materials identical to those removed.

D. Seal ducts and piping, and test for and repair leaks.

E. Seal insulation to reestablish integrity of the vapor barrier.

F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.

G. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

H. Change out variable pitched sheaves with fixed pitch sheaves after the balancing report is approved by the Engineer.

3.5 RECORD AND REPORT DATA:

A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.

B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

C. Provide VAV box airflow coefficients to Temperature Control Contractor and include in TAB reports.

D. Reports shall include final static pressure setpoints for tested AHUs and exhaust fans.

E. Reports shall include final cfm offset values in each laboratory area.

PART 4 - COMMISSIONING

4.1 GENERAL:

A. See Section 23 08 00 - Commissioning of HVAC Systems for additional information.

B. Coordinate all activities with the Construction Manager, Engineer, Mechanical Contractor, and the Temperature Control Contractor.

C. Work with the Engineer to field verify and adjust lab room cfm offset values.

END OF SECTION

SECTION 21 07 00
INSULATION - HVAC

PART 1 - GENERAL

1.1 SUMMARY:

A. This Section includes the furnishing and installation of thermal insulation for HVAC piping and equipment as indicated on the drawings, as specified herein, and as required for the proper and complete performance of the work.

B. Types of mechanical insulation specified in this Section include the following:
   1. Ductwork System Insulation:
      a. Fiberglass.
      b. Flexible Elastomeric.

C. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Section 07 84 00 - Firestopping for installation of firestopping materials at locations where insulated mechanical items penetrate fire-rated barriers; not work of this Section.
   2. Section 22 07 00 - Plumbing Insulation
   3. Section 23 00 10 - HVAC General Provisions
   4. Section 23 01 00 - Basic Materials and Methods – HVAC
   5. Section 23 07 10 - Insulation - HVAC Equipment
   6. Section 23 30 00 - HVAC Ductwork and Accessories for factory or shop installed insulating material occurring on interior side of ductwork; not work of this Section.

1.2 SUBMITTALS:

A. Submit under provisions of Section 01 33 00.

B. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation.

C. Submit a detailed schedule showing manufacturer's product number, k-value, thickness, r-factor, and furnished accessories for each mechanical system requiring insulation.

1.3 QUALITY ASSURANCE:

A. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulation's similar to that required for this project.

B. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E84 (NFPA 255) method and U.L. 723. Shipping containers for insulating materials shall bear the U. L. label.

C. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

D. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

1.4 WARRANTY:

A. Warrant replacement insulation installation for 1 year from date of final acceptance at no additional cost to Owner

PART 2 - PRODUCTS

2.1 DUCTWORK INSULATION MATERIALS:

A. Flexible Fiberglass for Concealed Ductwork: Provide blanket material complying with ASTM C553, 1 pcf minimum density, 250° F rated, with factory-applied reinforced foil/kraft vapor barrier facing; equal to Owens-Corning Fiberglas All Service Duct Wrap Insulation.

B. Semi-Rigid Fiberglass for Concealed Ductwork: Provide board material complying with ASTM C612, 4 pcf minimum density with factory-applied foil-reinforced kraft vapor barrier; equal to Owens-Corning Fiberglas Type 703.

C. Jackets for Ductwork Insulation:
1. ASTM C921, Type I (vapor barrier) for ductwork with temperatures below ambient.
2. ASTM C921, Type II (water vapor permeable) for ductwork with temperatures above ambient.
3. Two coats of vapor barrier mastic reinforced with fiberglass scrim cloth for ductwork exterior to building.
4. Sheet aluminum (0.016-inch minimum thickness) with longitudinal slip joints and 2-inch laps for ductwork installations exterior to building.

D. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

E. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF DUCTWORK INSULATION:

A. Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Do not insulate fibrous glass ductwork. Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing linings have been installed.

C. Install insulation materials with smooth and even surfaces. Clean and dry ductwork prior to insulating. Do not insulate ductwork for which leakage testing has been not been satisfactorily completed.

D. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered. Bevel and seal all exposed edges where access openings or other discontinuities occur in the installation.

E. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage. Seal all jacket seams, exposed edges, and penetrations with UL listed tapes or vapor retardant adhesives comparable to insulation jacketing material.

F. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated or where codes prohibit. Coordinate with firestopping Installer for ductwork through-penetrations at fire-rated barriers.

G. Protect outdoor insulation from weather by installing outdoor protective finish or jacketing as recommended by manufacturer.

H. Install corner angles on external corners of insulation on ductwork in exposed finished spaces (except for oven and hood exhaust duct insulation) before covering with jacketing.

3.3 PROTECTION AND REPLACEMENT:

A. Insulation Installer shall advise CONTRACTOR of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

B. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

3.4 SCHEDULES:

A. General: Insulation thickness, unless otherwise specified, shall comply with ASHRAE Standard 90A.

B. Ductwork Insulation Schedule:

Service	Thickness & Type of Insulation
Exposed Outdoor Air Ducts	2" Semi-Rigid Board
Concealed Supply Ducts	1.5" Semi-Rigid Board

END OF SECTION

SECTION 23 08 00
COMMISSIONING OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY:

A. This Section includes information relating to HVAC systems commissioning.

B. All Contractors shall work with and under the direction of the Engineer, Owner and Construction Manager / General Contractor to fully commission all systems as specified herein and in the technical specification sections. Commissioning activities include, but are not limited to, attending commissioning meetings, conducting field tests, performing startup and check, and assisting with test and balance activities, and writing and submitting commissioning reports for review and approval.

C. In this Specification, systems commissioning includes all activities relating to the demonstration and documentation of the mechanical systems installation and performance per the design intent and Owner's requirements.

D. The commissioning process includes the following activities:
1. Definition of Overall Design Intent and Sequences of Operation
2. List of Equipment Requiring Commissioning
3. Summary of Required Submittals
4. Overall Commissioning Checklist
   a. Field Tests and Submittals
   b. Startup and Check and Submittals
   c. Test and Balance and Submittals.
5. Commissioning Process Scheduling and Communication
6. Test and Balance Reports
7. Pre-Functional and Sequence of Operations Functional Check Lists by Lab Air Monitoring Contactor
8. Pre-Functional and Sequence of Operations Functional Check Lists by Temperature Control Contactor
9. System Demonstration
10. Owner Training
11. Project Record Documents

1.2 DEFINITION OF OVERALL DESIGN INTENT AND SEQUENCES OF OPERATION:

A. See Section 23 00 00 – HVAC General Requirements for a general description of all HVAC systems and the HVAC work scope.

B. See Section 23 09 20 – Direct Digital Temperature Controls and Instrumentation for a general description of the required commissioning activities of the Temperature Control Contractor.

C. See Section 23 09 90 – Sequences of Operation and Graphics for a general description of the required performance and a detailed description of the required sequences of operation

1.3 SCHEDULING AND COORDINATION:

A. The Construction Manager / General Contractor and the Temperature Control Contractor shall help coordinate all commissioning activities.

B. Coordinate meetings between the Owner, Engineer / Architect, the Construction Manager / General Contractor, the Mechanical Contractor, the Temperature Control Contractor and the Test and Balance Contractor to review commissioning procedures, plan the schedules, coordinate, and review progress.

1.4 TEST AND BALANCE REPORTS:

A. See Section 23 05 90 for a description of required Test and Balance work.

B. The Test and Balance Contractor shall work closely with the Mechanical Contractor and Temperature Control Contractor and help coordinate all activities.

1.5 TEMPERATURE CONTROL CHECK LISTS AND DEMONSTRATION:

A. The Temperature Control Contractor shall coordinate with the Engineer, the Construction Manager / General Contractor, the Mechanical Contractor, the MAU equipment vendor and the Test and Balance Contractor to schedule all activities

B. The Temperature Control Contractor shall develop and submit to the Engineer for approval complete point to point and functional checklists for each piece of equipment, each system, or each control sequence. See Section 23 09 20.

C. The Pre-Functional tests shall be used to verify that all control devices, sensors, actuators, etc. are properly wired, calibrated and functioning.

D. The Functional Check list is intended to represent a step-by-step process whereby each required control sequence, safety, operational parameter, etc. is verified and documented.

E. The Temperature Control Contractor shall work with the Engineer and Owner to modify the proposed lists as required.

F. After all systems have been properly commissioned, the Contractor shall demonstrate to the Engineer that all systems are operating as intended. See Section 01 75 00 and Section 23 09 20.

1.6 PROJECT RECORD DOCUMENTS:

A. See Section 01 78 00 - Project Record Documents and Section 23 00 00 - HVAC General Requirements for requirements.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 23 31 00
DUCTWORK AND DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Work of this Section includes ductwork and ductwork accessories.
1. Galvanized steel ductwork
2. PCD ductwork for laboratory exhaust applications
3. Insulated flex duct
4. Flexible laboratory exhaust hose
5. Access doors
6. Balance Dampers
7. Duct sealants
8. Miscellaneous ductwork accessories.

1.2 SUBMITTALS:

A. Submit under provisions of Section 01 33 00.

B. Submit product data for the following:
1. Duct application schedule showing intended use including location and system, material, pressure class, sealing class, gauge, coatings, and joining methods.
2. Duct sealant (non-VOC type)
3. Fire dampers
4. Access doors
5. Balance dampers
6. Typical branch takeoffs from mains
7. Duct fittings
8. Duct test ports
9. Flexible duct connections

PART 2 - PRODUCTS

2.1 METAL DUCTWORK AND FITTINGS

A. Metal ductwork shall be constructed of galvanized steel, stainless steel or aluminum and supported and braced as specified in Paragraph 2.2. Construct all ductwork as shown in the SMACNA duct manual.

B. All ductwork shall be joined by gasketed flanged fittings. Use approved sealant to caulk all joints and seams airtight. Sealant shall be free of VOCs and shall be suitable for use on LEED type projects (even though the project may not be submitted for LEED review).

C. Seal all transverse joints, longitudinal seams, and duct penetrations per SMACNA Seal Class A.

D. Existing lined duct sizes indicated as (AL) on the drawings are inside clear dimensions. Actual duct dimensions are two inches larger for both sides. New lined duct sizes indicated as (L) are exterior dimension. Actual inside duct dimensions are two inches smaller for both sides.

E. Joint and seams for rectangular ducts, elbows, tees and transformations are at least one gauge heavier than the duct material and all laps to be in the direction of air flow. No sheet metal screws used in the joining or fabrication of ducts when it is possible to use rivets and bolts. All edges and slips finished smooth inside the ducts. Joints and seams air tight.

F. Elbows and tees constructed with a centerline radius of at least one and a half times the duct diameter or equivalent duct dimensions in case of rectangular ducts, with single thickness turning blades unless shown otherwise on the drawings. The inlet stream edges of the blades shall be properly stiffened, installed straight and securely fastened by riveting to the inside of ducts.

G. All branch takeoffs shall be conical or 45 degree entrance type. No exceptions.

H. All ducts shall be braced and stiffened so as not to breathe, rattle, vibrate or sag. The bracing applied to the outside of all ducts same as shown in said schedule, and may consist of standing seams, modified angles, and cross breaking supplemented by angle stiffener. All ducts shall be adequately supported at not greater than 5 foot intervals.

I. The Contractor shall strategically locate balance dampers to accurately regulate the flow of air. Accessible means shall be provided for operating all dampers from the outside of the duct such as the use of damper quadrants or other approved means. Sheet metal screws shall not be used in the construction of dampers.

J. Ductwork includes the connecting of same to all equipment requiring duct. Where ductwork attaches to air handling equipment use approved flexible duct connectors.

K. Provide hinged access door at each fire damper, automatic damper, fan bearing, heating coil, filter, or control device within a duct or casing and anywhere that provision for maintenance, service, cleaning, or examination may be indicated or required. In general, access doors shall be sturdy, fit airtight (use felt or sponge rubber strips) and be a size as indicated on the drawings.

L. Flex duct shall not be permitted except where noted on the drawings.

2.2 INSULATED DOUBLE WALL GALVANIZED STEEL:

A. Double wall insulated rectangular duct shall be constructed of a solid galvanized steel outer shell and solid galvanized steel inner liner. The enclosed insulation shall be 1 inch thick, 1-1/2 inch lb/cubic foot density with R=3.6.

2.3 DUCT HANGERS AND SUPPORTS

A. All ducts shall be supported by 1/4 inch threaded rods and either angle type trapeze brackets or, for round ductwork, round saddle band.

2.4 POLYVINYL COATED DUCT

A. See Paragraph 2.01 for general installation requirements, duct support requirements, etc.

B. See the Ductwork Fabrication Schedule in this Section for additional requirements.

C. Exhaust duct that might exhaust air from chemical fume hoods or that otherwise might exhaust corrosive air shall be 4x1 PCD polyvinyl coated duct, internally coated with PVC.

D. Exhaust duct that might exhaust air from chemical fume hoods or that otherwise might exhaust corrosive air and whose exterior is also exposed to a corrosive environment shall be 4x4 PCD polyvinyl coated duct, internally and externally coated with PVC.

E. Duct shall be galvanized sheet steel, ASTM A527, coating G90, coated before fabrication with four mil dry film thickness of polyvinyl chloride (PVC) plastic suitable for temperature to 120° C (250° F). Material shall comply with UL 181, Class 1 (flame spread rating of not more than 25 and a smoke developed rating of 50 or less in accordance with ASTM E84). Provide compatible joint sealant and material for field coating of damaged areas.

F. Seal all transverse joints, longitudinal seams, and duct penetrations per SMACNA Seal Class A. Duct sealant shall be non-VOC type.

2.5 DUCTWORK FABRICATION SCHEDULE:

A. Table 2.05 provides a schedule of required duct systems.

B. See Section 23 07 00 – Insulation – HVAC for product data and schedules for interior duct lining. It shall be the responsibility of this Section (Section 23 30 00) to furnish and install duct lining as described in Section 23 07 00.

DUCTWORK FABRICATION SCHEDULE

SERVICE	MATERIAL	PRESSURE	SEAL CLASS
Supply Duct	GS	+6	A
Supply Duct	GS	+2	A
General Exhaust Duct	GS	+6	A
Corrosive Exhaust	PVC	-.5	?

2.6 LABORATORY FLEXIBLE EXHAUST DUCT:

2.7 FLEXIBLE DUCT CONNECTIONS

A. General Applications: Fabricated of neoprene-coated flameproof fabric crimped into duct flanges configured for attachment to duct and equipment. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.

B. Manufacturer: Ventfabrics, Inc. or equal as approved by Engineer.

2.8 DUCT SEALANTS

A. All duct sealants shall be non-VOC types, suitable for LEED type projects.

2.9 DUCT TEST PORTS

A. Provide Ventfabrics #699 Instrument Test Holes in all major supply ducts or otherwise in locations that will be tested by the TAB Contractor. Verify requirements and desired locations with the TAB Contractor.

PART 3 - INSTALLATION

3.1 INSTALLATION:

A. Install all items in accordance with manufacturer's instructions.

B. Install in first class and workmanlike manner, true to the dimensions indicated on the drawings, straight and smooth on the inside and with airtight joints.

3.2 COMMISSIONING – FIELD TESTS:

A. Leak Tests – General
1. Provide leak tests for all duct systems under the direction of the Engineer, Construction Manager, and Owner in the presence of the Owner as specified below and in accordance with SMACNA Air/Duct Leakage Tests.
2. Coordinate schedule with General Contractor, Engineer, and Owner. Provide at least 48 hours prior notice.
3. Disassemble, reassemble, and seal segments of the systems as required to accommodate leakage testing, and as required for compliance with test requirements.
4. Conduct tests, in the presence of the Engineer's and Owner's representatives, at static pressures equal to the maximum design pressure of the system or the section being tested. Do not pressurize systems above the maximum design operating pressure.
5. Remake leaking joints as required and apply sealants to achieve specified maximum allowable leakages.

6. Seal and leak test externally insulated ducts prior to insulation installation.
7. Provide testing on ductwork located in inaccessible locations (in walls and chases) before final covering is performed.
8. Maintain a log of all duct leakage tests.

B. Submittals
1. Submit leak test results to the Engineer for approval.

END OF SECTION

SECTION 23 34 00
FANS AND POWER VENTILATORS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Fans and Power Ventilators and Accessories.

1.2 SUBMITTALS:

A. Submit under provisions of Section 01 33 00.

B. Product data for specified equipment including
1. Fan model numbers, cut sheets, performance data, motor data, dimensional data, accessories, etc.

PART 2 - PRODUCTS

2.1 EXHAUST FANS

A. As scheduled on the drawings.

B. Provide all required accessories and components as scheduled on the drawings and otherwise as required for a complete working system.

C. Manufacturers: Fan Tech or equivalent as approved by the Engineer and Owner. See Section 23 00 00 – HVAC General Provisions regarding product substitutions.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. In accordance with manufacturer's instructions.

B. Provide all necessary incidental equipment, wiring and materials for complete installation. Allow adequate clearance around equipment, piping and fittings for maintenance and operation.

C. Provide adjustable pitch sheaves to aid in balancing. Test and Balance Contractor shall change out the adjustable pitch sheave with a fixed pitch sheave after balancing is complete.

END OF SECTION

SECTION 23 37 00
AIR INLETS AND OUTLETS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Air Inlets and Outlets.

1.02 SUBMITTALS:

A. Submit under provision of Section 01 33 00.
   1. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission.
   2. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
   3. Indicate all accessories and finishes.

B. Submit product data for the following items:
   1. Registers Diffusers and Grilles.

1.03 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.

B. Test and rate louver performance in accordance with AMCA 500.

PART 2 - PRODUCTS

2.01 REGISTERS, GRILLES, AND DIFFUSERS

A. See Schedules on drawings.

B. Allowable Manufacturers:
   1. Titus
   2. Kees
   3. Price
   4. Other manufacturers as determined equal by the Engineer prior to bid. See Section 23 00 00 - HVAC General Provisions for additional requirements for substitutions.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install all items in accordance with manufacturer's instructions.

B. Install in first class and workmanlike manner, true to the dimensions indicated on the drawings, straight and smooth on the inside, and with airtight joints

3.02 SUPPLY AIR DIFFUSERS

A. Adjust all air directional vanes and sectorizing baffles so as to direct all airflow in the fully horizontal position. Verify desired vane direction with Engineer prior to adjusting.

END OF SECTION

SECTION 26 05 00
ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. General provisions for electrical work for improvements to the City of Jonesville Wastewater Treatment Plant Laboratory.

B. Work performed for the electrical system upgrades will require coordination and phasing necessary to keep the lab operational throughout the upgrades. Refer to Division 1 for more details to required phasing of electrical work.

1.02 SUMMARY OF WORK:

A. General:
1. Prior to performing the work, the Contractor shall familiarize himself with the site, and be aware of limitations to consider when accessing the work location with construction equipment. Coordinate all work on site with the Engineer, particularly related to sequence, placement, storage, lifting, etc. of all construction equipment and materials.
2. Obtain permits required by the local jurisdictions for work performed by this Contract.
3. Coordinate layout and installation of all work for this Contract with other Contractors on site and through the Engineer.
4. Furnish and install all support devices including: miscellaneous steel, hangers, brackets, clamps, anchors, etc. as required to adequately install, support, and maintain all conduit, cables, lighting, distribution equipment, instruments, devices, and fixtures installed by this Contract.
5. Layout, coordinate, furnish and install all sleeves, flashing, and patching as required for all wall, roof, floor, grating, etc. penetrations for all work by this contract. Utilize a roofing contractor for cutting and patching at all roof penetrations for piping and supports.
6. Field touch-up paint to existing condition, all equipment damaged or installed by work by this Contract in accordance with Owner's painting standards and the technical specifications.
7. Coordinate deliveries, receipt, handling, off-loading, storage and security for all Contractor furnished materials. Owner or Engineer will not be responsible for lost or stolen materials furnished by Contractor and will not assume responsibility for materials until satisfactory installation. Coordinate on site storage of all Contractor furnished materials and equipment with the Engineer.
8. Receive, inspect, off load, store, stage, and protect all equipment, devices, and materials furnished by the Owner for this Contract.
9. Furnish and install all equipment grounding.
10. "Commission" or energize all equipment and systems installed by this contract including coordination with Engineer and other contractors.
11. Provide start-up assistance for systems furnished under this contract.
12. Maintain on site a detailed as-built record set of all work installed by this Contract as applicable. Final set to be submitted to Engineer upon completion of work.

B. General Demolition Requirements:
1. Refer to the drawings for specific demolition of electrical panels, electrical equipment, and other items as noted on the drawings. Remove associated conduit, supports and wiring along with the equipment.
2. All abandoned conduits exposed in buildings that are not scheduled to remain shall be removed and properly disposed of per Division 1 requirements.
3. Patch with grout all walls and surfaces that are penetrated by electrical equipment that is removed. Patch all holes made by mounting hardware. Paint all patch material to match existing surface coating. Match external grout to mortar color.

1.03 STANDARDS:

A. Applicable Standards and Codes:
1. Institute of Electrical and Electronic Engineers (IEEE).
2. Underwriters Laboratories, Inc. (UL).
3. National Electrical Manufacturers Association (NEMA).
4. National Electrical Code (NEC).
5. American Society for Testing and Materials (ASTM).
6. American National Standards Institute (ANSI).
7. National Board of Fire Underwriters (NBFU).
8. National Fire Protection Association (NFPA).
9. National Electrical Contractors "Standard of Installation" (NECA)
10. Joint Industrial Council (JIC).
11. Code of Federal Regulations (CFR). Title 29 Labor, Subpart S-Electrical.

B. Where quantities, sizes, or other requirements shown on the Drawings or specified herein exceed the requirements of the above standards and codes, the Drawings and Specifications shall govern.

1.04 SUBMITTALS:

A. Submit under provision of Division 1.

B. Submit materials and equipment for review to ENGINEER as required in each Section. Each sheet of descriptive literature submitted shall be clearly marked to identify the material or equipment and shall show the specification paragraph for which the equipment applies.
1. Submit schematics and connection diagrams for all electrical equipment. A manufacturer's standard connection diagram or schematic showing more than one scheme of connection will not be accepted unless it is clearly marked to show the intended connections.
2. Submittals showing more than the particular item under consideration shall have the pertinent description paragraph for which the equipment applies circled, or "high-lighted" with a marker intended for that purpose.

C. Prepare and maintain Record Drawings current with work completed. Show all changes to underground and other hidden work. Submit to ENGINEER on completion of project.

D. Provide records of insulation test (megohm check) on buried conductors directly buried and in conduit.

E. After award of the contract and prior to starting any work the CONTRACTOR shall submit to the ENGINEER:
1. List of Subcontractors scheduled and planned for utilization on the project.
2. Detailed work plan outlining methods and procedures to accomplish the intent and purpose of the Contract.
3. Work schedule detailing dates of principle events and completion date. All downtime needed in the schedule shall be approved by the OWNER.

F. Operating and Maintenance Instructions:
1. Upon completion of all Work and tests, instruct the OWNER in the operation and maintenance of all components.
2. Furnish sets of written Operation and Maintenance Manuals per Division 1 -Submittals.

1.05 CLEARANCES:

A. Equipment:
1. Maintain clearances from electric panels, and other electrical installations as required by NEC and CFR.
2. Maintain working clearances around electrical equipment as required for proper maintenance and operation.

1.06 IDENTIFICATIONS:

A. General:
1. Provide identification signs on all equipment, switches, breakers, and panels.
2. Attach nameplates directly to each piece of electrical equipment.

1.07 CODES AND STANDARDS:

A. These specifications are minimum requirements and shall govern except where made more stringent by other sections of this specification or local, state, or federal laws or regulations. In the event of conflict between these specifications and applicable codes and regulations, the codes and regulations shall govern.

1.08 PERMITS AND INSPECTIONS:

A. Obtain all necessary permits and pay all fees in connection with all permits, inspections, and approval by the proper authorities in local jurisdiction of such work. Final inspection by the OWNER will not occur until necessary certificates of satisfactory inspection are received.

1.09 DRAWINGS:

A. Drawings and Specifications are provided for assistance to the CONTRACTOR and are diagrammatic only to indicate the general arrangement and location of circuits, outlets, etc. Exact locations will be determined by field conditions. Deviations from the arrangement indicated to meet actual conditions shall be made with no expense to the OWNER. Throughout the progress of construction, the CONTRACTOR shall keep a set of detailed field record drawings, including the exact location of concealed work and underground utilities. This requirement does not authorize any deviations from the Contract Drawings without prior approval from the OWNER. The field record information shall be marked in a legible manner on prints of the Drawings. At the completion of work, the CONTRACTOR shall deliver the field record information to the OWNER.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. All electrical equipment and material shall be furnished new and shall be accepted, or certified, or listed or labeled or otherwise determined to be safe by a nationally recognized testing laboratory (NRTL).
1. Equipment shall be accepted, certified listed labeled by Underwriters Laboratory, Inc. (UL) Factory Mutual, Inc. (FM).
2. Equipment or material accepted certified, listed or labeled by an accepted NRTL shall be used in preference to equipment or material that does not have that acceptance.
3. If equipment or material has been inspected or tested by a Federal Agency or by the State of Michigan or by the municipality having jurisdictional responsibility for enforcing occupational safety provisions of the National Electrical Code (NEC) and found in compliance with the provisions of the NEC as applied in Paragraph 1910.309 of Department of Labor General Industry Safety Standards Commission Bulletin.
4. Custom manufactured or installed equipment shall use components accepted, certified, listed or labeled by a NRTL and manufactured shall submit data indicating such acceptance, certification listing or labeling to the ENGINEER.

B. Substitutions for materials and equipment listed herein must be of equal standards, quality and desired operation, or superior. There will be no approval or consideration for approval of equipment or material submittals for substitution prior to Award of the Contract.

C. All packaged equipment shall be completely factory wired prior to delivery to the job site. Connection to and bonding of this equipment is required under this section of the specifications.

1. Check all prewired controls before energizing to verify that all internal wiring is properly coordinated to the voltage to be applied.

2.02 SHOP/FACTORY/FINISHING:

A. Provide baked enamel finishes on exposed surfaces.

B. Provide galvanized finishes for damp or wet locations.

C. Touch up or refinish damaged paint.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Provide and install all equipment as specified, required or implied in this specification except as noted. This requirement shall include all labor, materials, and incidentals in a manner consistent with good practice necessary to a complete operable installation.

B. The CONTRACTOR shall implement cooperation with other trades by his reference to the Mechanical Drawings and Specifications for work by other trades and to be carried on simultaneously or sequentially with the electrical work. This requirement is to facilitate construction to proceed with no harm to the OWNER due to the absence of cooperation. All other Drawings and Specifications shall become part of the Electrical Specifications as they relate to electrical work.

C. Verify equipment dimensions to insure dimensional compatibility.

D. The CONTRACTOR is responsible for connecting wiring and circuitry to all equipment furnished by others and the CONTRACTOR that requires electrical power or control.

E. The CONTRACTOR shall demonstrate to the satisfaction of the OWNER at final inspection that the wiring is complete and free from open circuits, short circuits between circuits or ground and that systems operate satisfactorily. The entire electrical installation shall be demonstrated to operate in accordance with the specifications.

3.02 TEST AND OPERATION:

A. Equipment:
1. Thoroughly clean, lubricate, and protect from damage and dirt during operation.
2. Test and operate in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 26 05 19
ELECTRICAL CONDUCTORS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work of this Section includes electrical conductors (wire and cable) for all types of applications 600V and below.

1.02 RELATED SECTIONS:

A. Section 26 27 26 - Wiring Devices.

1.03 SUBMITTALS:

A. Submit under provision of Division 1.

B. Provide voltage and insulation test data from the cable manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLINE:

A. Cable shall be on original reels or in boxes and shall be new and unused.

B. Store cables in dry protected area and protect cable ends in accordance with manufacturers' recommendations.

PART 2 - PRODUCTS

2.01 LOW VOLTAGE, LIGHTING AND POWER CONDUCTORS:

A. Conductors provided on 120/208 and 277/480 volt power and lighting systems to be stranded per ASTM B-8 soft drawn copper.

B. Insulation system shall be type THHN/THWN or THWN-2, 75/90°C rated 600V as defined and listed in Article 310 of NEC.

C. Minimum size conductor utilized shall be #14 AWG for control circuits and #12 AWG for power and lighting circuits.

D. Color code conductor insulation as follows:

1. Line Voltage - Black
2. Grounding Conductor - Green
3. Neutral - White
4. Control - Red
5. DC Circuits - Blue
6. Voltage from External Source - Yellow
7. Color shall be integral with the insulation compound applied by cable manufacturer.

E. Phase conductor color code as follows:

1. Under 250VAC; black, red, blue.
2. Over 250VAC; brown, orange, yellow.

PART 3 - EXECUTION

3.01 LOW VOLTAGE LIGHTING AND POWER CABLES:

A. Install only after completion of work, which might cause damage to wires or conduit.

B. Clean out or replace conduit in which dirt, water, concrete, or other foreign matter has been allowed to accumulate, before installing wiring.

C. Use THHN/THWN or tray rated cable and wire for routing in cable tray.

D. Identify each end of each conductor by wire marking tape or sleeve. Mark on outer cover giving voltage, type, size, and circuit number.

E. Splices:
1. No wire splices allowed in entire length of conduit or raceway.
2. Make splices in electrical enclosures.
3. Splice Insulation: Equal to original factory insulation.
4. Splicing Copper to Aluminum: Use aluminum-copper connections; approved as suitable for the purpose.

F. Termination of Conductors:
1. Insulated type compression lugs.
2. At distribution equipment containing aluminum bus bars, use aluminum copper lugs rated and approved for the application.

G. Provide separate conduit for each type of circuit (power, controls, and communications).

H. Conductors terminating at outlets shall be left not less than 8 inches long within outlet box.

I. Low voltage and signal cable splices located in handholes and wet locations shall be sealed in 2-part epoxy sealing pack, 3M Scotchcast connector sealing pack 3570G.

3.02 GROUPING OF CABLES:

A. Lace or plastic band groups of feeder conductors at distribution centers, pull boxes and wireways.

3.03 WIRE PULLING:

A. Use wire pulling lubricant for pulling (No. 4 AWG) and larger wire. Do not pull cables through conduit with more than allowable bends specified in NEC 345-11. Only approved pulling compound that is suitable for the type wire insulation is allowed.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING

PART 1 - GENERAL

1.01 DESCRIPTION:

A. The Work of this Section includes equipment for an effective grounding system.

1.02 SUBMITTALS:

A. Submit under provisions of Division 1.

B. Certified ground resistance tests on each ground rod and the complete service system consisting of multiple rods and grounding conductor.

C. Ground resistance tests on total systems.

1.03 STANDARDS:

A. IEEE Standard 142.

B. NEC Article 250.

PART 2 - PRODUCTS

2.01 EQUIPMENT GROUNDING CONDUCTORS:

A. Equipment grounding conductors shall be copper sized in accordance with Table 250-122 of NEC.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Bond the non-current carrying parts of all electrical equipment installed under this contract including metallic raceways, raceway supports, motors, equipment enclosures, and metallic cable sheaths by means of bare copper cable or copper strap to the station grounding system or as shown.

B. All power, lighting over 120 volts and receptacle circuit conduits shall include a ground conductor sized per the NEC. Attach grounding conductors to equipment by means of approved copper alloy solderless grounding lugs or clamps which shall be secured to the equipment and the grounding point by means of hexhead cap screws or machine bolts after the contact surfaces have been cleaned to bright metal.

C. Ground conductors run in conduit with circuit conductors are to be securely connected inside the junction boxes or enclosures. Splices in ground conductors shall be made by the "Cadweld" process by Erico Products, Inc., Continental Industries "Thermoweld", or equal.

D. Support ground straps at intervals not exceeding two (2) feet by means of round head bronze machine screws and approved type anchors.

E. All circuits in non-metallic raceways shall include a ground conductor sized per the NEC or as shown. Attach grounding conductors to equipment by means of hexhead cap screws or machine bolts after the contact surfaces have been cleaned to bright metal. Ground conductors terminating at the motor control centers, switchgear to be terminated at the ground bus.

F. Bond interior metal piping systems and metal air ducts to equipment ground conductors of pumps, fans, and electric heaters.

END OF SECTION

SECTION 26 05 33
CONDUIT

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work of this Section includes electrical conduit systems.

1.02 SUBMITTALS:

A. Submit under provision of Division 1.

1.03 RELATED WORK:

A. Section 26 05 34 - Junction, Pull, and Outlet Boxes.

B. Section 16135 - Electrical Handholes and Manholes.

PART 2 - PRODUCTS

2.01 CONDUIT:

A. Intermediate Metal Conduit (IMC):
1. Intermediate metal conduit (IMC) shall be galvanized, threaded, conforming to UL 1242 and ANSI C80.6.
2. Acceptable manufacturers: Allied Tube and Conduit, Republic and Wheatland Tube.

B. Electrical metal tubing (EMT):
1. Electrical metal tubing (EMT) shall be galvanized, conforming to UL 797 and ANSI C80.3.
2. Electrical metal tubing may be used in the Administration and Maintenance Building areas only.
3. Acceptable manufacturers: Allied Tube and Conduit, Republic and Wheatland Tube.

C. Rigid Nonmetallic Conduit:
1. Rigid nonmetallic conduit shall be PVC schedule 40 or schedule 80 heavy wall, rated for 90 degrees C conductors and for use in direct sunlight conforming to UL 651 and Federal Specification W-C-1094A.
2. Use only couplings and fittings designed specifically for the type of conduit noted. Follow the manufacturer's recommendations regarding the handling, bending, coupling and installation.
3. Acceptable manufacturers: Robroy Industries; Perma-Cote, Plasti-Bond, Kor Kap and Thomas & Betts.

D. Flexible Metal Conduit:
1. Liquidtight Flexible Metal Conduit shall have flexible interlocking steel, spiral strip, galvanized with oilproof and waterproof flexible PVC jacket, conforming to UL standards.
2. Acceptable manufacturers: Anamet Electrical, Inc., Southwire Company, ABB T&B, or equal.

2.02 COUPLINGS AND CONNECTORS:

A. For electrical metal tubing, couplings and connectors to be steel compression type, and of the same manufacturer.

B. For rigid non-metallic PVC conduit, couplings to be PVC, liquid tight, suitable for the conduit with which the couplings are used and of the same manufacturer.

C. Flexible conduit connectors shall be corrosion resistant metallic compression gland, liquid tight type.

D. Connectors to metallic boxes or conversion to metallic conduit: provide adapters as recommended by conduit manufacturer to provide a watertight threaded connection.

2.03 FITTINGS:

A. UL listed.

B. For metallic conduit, liquid tight, malleable iron alloy body and cover, zinc coated and stainless steel screws.

C. For nonmetallic conduit, liquid tight, utilizing the same non-metallic material as used in the conduit for body and the cover. Cover screws shall be stainless steel.

2.04 CLAMPS & HANGERS:

A. Hot dipped galvanized malleable iron straps with back spacers, and hot dipped galvanized strap hangers with zinc plated threaded rods and hardware.

B. PVC or other nonmetallic straps as recommended by the conduit manufacturer for the non- metallic conduit. Any metallic screws, bolts, nuts or other attachment hardware to be stainless steel.

C. Trapeze type hangers shall be:
1. For galvanized conduit, use galvanized steel channel support system with (zinc plated) threaded rod and hardware, as manufactured by Super-Strut or Unistrut.
2. For nonmetallic conduit, use fiberglass strut support system or PVC coated strut support system with plastic coated or stainless steel hardware.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install the conduit in accordance with the manufacturer's recommendations. All buried conduits outside of buildings shall have locations marked on drawings. Minimum conduit size shall be ¾". In no event shall the conduit size be less than required by National Electric Code for the wire size and number indicated. Galvanized conduit shall not be painted except where shown.

B. Utilization Areas:
1. Use EMT conduit in dry above grade, office type areas.
2. Use IMC conduit in lab areas and other potentially damp areas.
3. Use RGS/RMC conduit outdoors or in wet areas.
4. Use PVC Schedule 80 conduit for underground construction or in the presence of corrosive liquids or environments.
5. Use PVC Schedule 40 conduit for under-ground-under-slab construction.
6. Use Liquidtight Flexible Metal Conduit for:
    a. Motor and solenoid terminations and termination to vibrating equipment.
    b. Termination to instrumentation and control field devices.
    c. Installation not to exceed 3 ft.

C. General Installation Guidelines:
1. Metal conduit systems shall be bonded to grounding systems at each enclosure connection.
2. Run conduit parallel to or at right angles to building lines, except when in concrete slab or run under base slab. Support conduit at a maximum of 8 feet on center.

3. Bends for low voltage wiring shall be standard ells with a maximum equivalent of (4) four quarter bends in any run between pulling joints. Bends for medium voltage wiring shall be wide radius ells with a maximum equivalent of (3) three quarter bends in any run between pulling joints.
4. Paint the ends of RMC/IMC joint couplings or threaded fittings with zinc rich coating of at least 90% purity zinc. Use cold galvanizing compounding ZRC Products Co. or Zinc-It or equal.
5. Fasten all conduits entering boxes with locknut and bushing in the inside and locknut on the outside.
6. Furnish and install Liquidtight Flexible Metal Conduit connections to all motors, light fixtures, solenoids and vibrating equipment. Conduit shall be a minimum 18 inches in length and shall be sufficiently long to enable motor to be moved to allow the disconnecting of the motor coupling without disconnecting the motor and shall be equipped with approved type grounding devices to ensure continuity between the conduit and the connection. In all cases, Flexible Metal Conduit runs shall not exceed 6 feet in total length.
7. Clean all conduit thoroughly inside and outside after installation and just before pulling cables. All conduits not terminated in metal fittings or metal cabinets and secured with locknuts shall be terminated with grounding bushings.
8. Install only undamaged conduit. Plug ends to prevent entry of dirt and moisture.
9. Layout conduit routing to avoid structural obstructions and minimizing crossovers. Conduit runs must be installed in a neat and well planned arrangement and in a manner that will not interfere with access to equipment or with the use of access ways.
10. Seal conduit with duct seal where conduits leave heated area and enter unheated area.
11. Provide flashing and pitchpockets in making watertight joints where conduits pass through roof or waterproofing membranes.
12. Install UL approved expansion fittings complete with grounding jumpers where conduits, metallic or non-metallic cross building expansion joints. Provide bends or offsets in conduit adjacent to building expansion joints where conduit is installed above suspended ceilings. In exposed PVC conduit runs longer than 50 feet, provide expansion couplings near boxes or devices. In exposed PVC conduit runs which do not have devices or boxes, an expansion coupling shall be installed for every 100 lineal feet of conduit.
13. Whenever PVC is used, install a separate ground wire, and use rigid ells where exterior or poured concrete surfaces are penetrated. Also, provide rigid elbows where necessary to prevent "burn-through" of PVC conduit when pulling wire.
14. Make transitions between nonmetallic conduits and conduits of other materials with the manufacturer's standard adapters designed for such purposes.
15. Conduit shall be securely attached to the building structure. Unless otherwise indicated, all electrical equipment shall be spaced at least 1/2 inch from the wall with hanger clamps to Unistrut, Super Strut, or equal.
16. For single metallic conduit runs use galvanized conduit straps or ring bolt type hangers with specialty spring clips. Perforated strap is not allowed. Groups of conduits shall be supported on trapeze type hangers, Unistrut, or equal. Individual conduits not supported on conduit straps shall be provided with clevis type hangers. Hanger support shall be rod with threaded connections.
17. Conduit entering control panels shall not be made where conductors will obstruct internal components and shall allow for neat and workmanlike wire management.
18. Provide listed sealant in underground and above grade conduit that is exposed to temperature differences to prevent the passage of air and condensation

D. Anchor Methods:
1. Hollow Masonry: Toggle bolts or spider type expansion anchors.
2. Solid Masonry: Lead expansion anchors or preset inserts.
3. Metal Surfaces: Machine screws, bolts, or welded studs.
4. Wood Surfaces: Wood screws.
5. Concrete Surfaces: Self-drilling anchors or power-driven studs.

E. Conduit runs as indicated on drawings are schematic, exact routing of conduit to be approved by the Engineer. Make field bends and offsets uniform and symmetrical, without flattening conduit or scarring conduit finish and of minimum radius for each size as given in NEC Article 346.

F. Conduit shall be as shown on plans and/or as required for the installation of outlets and devices shown on drawings. All conduits shall be supported from the structure or provided rods independent of all other trades. Proper location of conduits shall be the responsibility of the Electrical Contractor who shall avoid interferences with other trades.

G. Install a pullwire in all empty conduits. All empty conduits installed for future use shall be capped or plugged and properly identified.

H. Drains are required where it is probable that liquid or any condensed vapor may be trapped within enclosures, accumulated on seals, or accumulated at any point in the raceway system. All drains shall provide continuous draining. Drains shall be provided as follows:

1. At the low points of any conduit system where any portion between seals is outdoors, in a tank, or in a building without heating facilities. Note especially any vertical sealing fittings.
2. At any device located below grade where conduit is routed directly from outdoors and into device.
3. At any control or wiring enclosure that is outdoors or in a building without heating facilities.
4. At any Class I enclosure with internal volume of more than 400 cubic inches. The drain may be provided by the conduit system.
5. At canned pumps, process instrument, etc., which have only a single seal to prevent process fluids from entering the wiring system. This drain must be "adequate" and should make any leak "obvious" per NEC Article 501-5(d) (3).
6. Regardless of any(other) sealing method.

I. Conduits that enter NEMA Type 2, 3, 3R, 4, 4X, and 12 enclosures; provide fittings with o-ring gaskets suitable for the environment served. Grounding hubs shall be used with nonmetallic enclosures.

END OF SECTION

SECTION 26 05 34
ELECTRICAL BOXES

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work of this Section includes junction boxes, pull boxes, and outlet boxes for interior, exterior, and hazardous locations.

1.02 RELATED SECTIONS:

A. Section 26 05 33 – Conduit.

PART 2 - PRODUCTS

2.01 JUNCTION, PULL, AND OUTLET BOXES:

A. All boxes used outdoors with rigid steel galvanized conduits shall have malleable iron body and cover with stainless steel screws. The finish shall be zinc electroplate and aluminum polymer enamel.

B. All boxes used indoors with rigid steel galvanized conduits shall be Pressed steel hot dip galvanized as specified in Part C below.

C. All boxes used with EMT shall be pressed steel, hot dip galvanized suitable for flush or surface installation.

D. Junction boxes set flush in interior concrete ceiling and walls shall be PVC.

E. Junction boxes set flush in exterior walls shall be PVC.

F. Junction boxes set flush in exterior concrete slabs shall be hot dipped galvanized cast iron. Cover shall be same material as box with checkered plating design and neoprene gasket. Box shall be an OZ- Gedney Type Y-T or equal by Appelton. Box shall have a minimum 6" depth.

G. Junction and pull boxes used with non-metallic conduits shall be (PVC).

H. All boxes shall be UL listed and conforming to area classification. Boxes shall be NEMA 1, NEMA 4X and NEMA 7 unless specified otherwise on drawings.

PART 3 – EXECUTION

3.01 INSTALLATION:

A. Clean interior of boxes of moisture, dirt, metal filings or other foreign matter.

B. Assure that all conduit fittings that enter the box are tight and secure.

C. Locate boxes in walls and on other surfaces as shown on the drawings.

D. In rooms and areas having a corrosive atmosphere use only PVC or molded fiberglass boxes.

END OF SECTION

SECTION 26 05 53
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes electrical identification of electrical materials, equipment and installations. It includes requirements for electrical identification components including but not limited to the following:
   1. Buried electrical line warnings.
   2. Identification labeling for raceways, cables and conductors.
   3. Operational instruction signs.
   4. Warning and caution signs.
   5. Equipment labels and signs.
      a. Controls/Controllers:
         1) Motor starters.
         2) Variable frequency drives.
         3) Lighting control relay panels.
         4) Lighting contactors.
      b. Distribution Equipment:
         1) Disconnect switches.
         2) Enclosed circuit breakers.
         3) Switchboards.
         4) Transformers.
         5) Panelboards.
         6) Motor control centers.
   6. Receptacle circuit labels.
   7. Spare future conduits.
   8. High voltage equipment.
   9. Fire alarm system equipment.

B. Refer to other Division 26 sections for additional specific electrical identification associated with specific items.

1.02 SUBMITTALS:

A. Product Data: For each electrical identification product required on the project.

B. Nameplate schedule identifying each device to be labeled and project specific label text.

1.03 QUALITY ASSURANCE:

A. Comply with ANSI C2.

B. Comply with NFPA 70.

C. Comply with ANSI A13.1 and NFPA 70 for color-coding.

PART 2 - PRODUCTS

2.01 CABLE LABELS:

A. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letters.

C. Color: Black letters on white field.

D. Label Information: Indicate voltage and if applicable service.

2.02 NAMEPLATES AND SIGNS:

A. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.

B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch thick for signs up to 20 sq. in, or 8 inches in length; and 1/8 inch thick for larger sizes.

C. Color: Black letters, 1/2-inch minimum, on white face except for emergency systems listed in NFPA 70, Article 700, or as directed by the Owner.

D. Nameplates shall be punched or drilled for mechanical fasteners.

E. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for the application. 1/4-inch grommets in corners for mounting.

F. Fasteners for Nameplates and Signs: Self-tapping, stainless steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.03 UNDERGROUND LABELS:

A. Underground line marking tape: permanent, bright-colored, continuous printed, plastic tape compounded for direct-burial service not less than 6 inches wide by 4 mils thick. Printed legend indicative of general type of underground line below.

2.04 MISCELLANEOUS IDENTIFICATION PRODUCTS:

A. Self-Adhesive Label: Electronic Label Maker, imprinted, pressure-sensitive, abrasion-resistant plastic tape.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment, in accordance with manufacturer's written instructions and requirements of NEC.

B. Identify the feeder circuit for each receptacle and data jack on the cover of each receptacle or on cover of the plugmold adjacent to the receptacle/jack. Unless noted otherwise, all new, newly circuited or updated receptacles shall be labeled.

C. Identify high-voltage feeder conduits (over 600V) by words "DANGER-HIGH VOLTAGE KEEP OUT" in black letters 2 inches tall, stenciled at 10-foot intervals over painted orange background. Identify all rooms containing equipment such as medium voltage switches, transformers, junction and pull boxes for medium voltage cables, and on medium voltage equipment mounted outdoors, such as pad-mounted transformers and switches.

D. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.

E. Installation:
1. Self-Adhesive Identification Products: Clean surfaces before applying.
2. Install nameplates and labels parallel to equipment lines.
3. Attach nameplates directly to each piece of electrical equipment. In finished areas of building, install nameplates behind enclosure door where possible.

F. Identify junction, pull and connection boxes: Code-required caution sign for boxes shall be pressure-sensitive, self-adhesive label indicating system voltage in black, preprinted on orange background. Install on outside of box cover. Also label box covers with identity of contained circuits. Use pressure-sensitive plastic labels at exposed locations and similar labels or plasticized card stock tags at concealed boxes.

G. All surface and flush mounted wiring devices (light switches, receptacles, etc.) shall have the power circuit identified, in permanent marker or pen, on the back (inside) of the device cover plate and receptacles and data jacks with a self-adhesive nameplate on the face of the cover plate.

H. Underground electrical line identification: During trench backfilling, for exterior underground power, signal and communication lines, install continuous underground plastic line marker, located 12 inches directly above conduit. Where multiple lines installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches: install a single line marker.

I. Color-Coding of Secondary Phase Conductors: Refer to Section 26 05 19.

J. Tag or label conductors as follows:
1. Future connections: Conductors indicated to be for future connection or connection under another contract with identification indicating source and circuit numbers.
2. Multiple circuits: Where multiple branch circuits or control wiring or communications/signal conductors are present in the same box or enclosure (except for three-circuit, four-wire home runs), label each conductor or cable. Provide legend indicating source, voltage, circuit number, and phase for branch circuit wiring. Phase and voltage of branch circuit wiring may be indicated by means of coded color of conductor insulation. Use consistent letter/number conductor designations throughout on wire/cable marking tapes.
3. Motor Leads: Provide label on each end of conductor including motor starter number and motor starter terminal number.
4. Motor Control Center Control Circuits: Provide labels on each end of conductor including motor starter number and motor starter terminal number for all field control circuits.
5. Instrument Control Panel Circuits: Provide labels on each end of conductor with the same naming convention as that located in the source control panel. Provide a label suffix corresponding with the instrument control panel circuit originates from.

K. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:

L. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.

M. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

N. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum 3/8 inch high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

O. Switch Identification Labels: Self-Adhesive Tape. Install on each switch when there are more than two switches under one faceplate or if switches are used to control exhaust fans or other equipment. Unless otherwise indicated, provide a single line of text with 1⁄8-inch high black lettering on clear background. Label shall indicate load controlled.

P. Apply circuit/control/item designation labels of engraved plastic laminate for disconnect switches, breakers, pushbuttons, pilot lights, motor control centers and similar items for power distribution and control components above, except panelboards and alarm/signal components, where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

Q. Furnish and install a sign at the service entrance equipment indicating type and locations of on-site emergency power sources. Sign shall be 8x10-inch minimum size mounted on the face on the switchboard.

R. Provide suitable permanent means of labeling spare conduits. Provide legible means of identifying the location of where each conduit originates. Provide the same identification at each end.

S. 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").
3. Lighting Control Relay Panels:
   a. Name of device as indicated on relay panel riser diagram (example, "RP-1").
   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.
4. Lighting Contactors: Name of device and equipment served/controlled (example, "LC-1, Site Lighting").

T. 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, FED FROM MDP-A").
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, ED FROM MDS-1").
   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, voltage-phase, and panel fed from (example, "LPA, 208Y/120V-3Ø, Fed From: PP-Y").
   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.
6. Motor Control Centers:
   a. Name of device as indicated on one-line diagram and voltage-phase (example, "MCC-1, 480V-3Ø, FED FROM MDB-2").
   b. Provide label on each motor control center compartment identifying type of device, device rating, load served, and load characteristics (examples, "MOTOR STARTER, SIZE 1, P-1, 10 HP or CIRCUIT BREAKER, 3P20, HOIST, 1 TON"). Provide labels for spare devices and spaces.

U. Fire Alarm System Equipment:
1. 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").
2. Junction boxes used for fire alarm system wiring shall be red.

V. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide text with 1/2 inch high lettering on 1-1/2 inch high label; where two lines of text are required, use labels 2 inches high. Use black lettering on white field. Apply labels for each unit of the following categories (not all categories may be required on the project) of equipment using mechanical fasteners:
1. Panelboards, electrical cabinets, and enclosures. Include series rated labeling if required.
2. Access doors and panels for concealed electrical items.
3. Electrical switchgear and switchboards. Include series rated labeling if required.
4. Emergency system boxes and enclosures.
5. Motor-control centers.
6. Disconnect switches.
7. Enclosed circuit breakers.
8. Motor starters.
9. Push-button stations.
10. Contactors.
11. Remote-controlled switches.
12. Control devices.
13. Transformers.
14. Variable frequency drives.
15. Power generating units.
16. Timers/time clocks.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Wiring devices including but not limited to receptacles, power receptacles, disconnect type welding receptacles, light switches, wall plates, cover plates, Isolated Ground receptacles, GFIC receptacles, pushbuttons, surface raceway, plug-mold, selector switches, line voltage thermostats, and surge suppression receptacles.

1.02 RELATED SECTIONS:

A. Section 26 05 34 - Electrical Boxes.

1.03 SUBMITTALS:

A. Submit under provision of Division 1.

B. Product data of all types of items supplied.

C. Submit sample cover plates to Owner for approval prior to installation.

PART 2 - PRODUCTS

2.01 RECEPTACLES:

A. General: Typical receptacle types are listed below. Where more specialized receptacles are required to match existing equipment, but not listed below, provide receptacles of equivalent type and quality.

B. Duplex receptacles shall be heavy duty, specification grade, full gang size, polarized, duplex, parallel blade, rated at 15 amperes, 120 volts, conform to NEMA 5-15R and Federal Specification W-C-596. Receptacles shall be Hubbell 5262 or equal by Leviton or GE.

C. Duplex receptacles shall be extra heavy duty, specification grade, full gang size polarized, duplex, parallel blades, grounding type, rated at 20 ampere, 120V conforming to NEMA (5-20R). Receptacles shall be Hubbell 5362 or equal by Leviton or GE.

D. Single receptacle shall be extra heavy duty, specification grade, full gang size polarized, parallel blades, grounding type, rated at 2-pole, 3 wire 20 ampere, 240V conforming to NEMA (6-20R). Receptacles shall be Hubbell 5461 or equal by Leviton, Cooper.

E. Twist-lock style single receptacle shall be heavy duty, specification grade, full gang size polarized, duplex, locking blades, isolated grounding type, rated at 2-pole, 3 wire, 30 ampere, 250V conforming to NEMA (L6-30R). Receptacles shall be Hubbell IG2620 or equal by Leviton, Cooper

F. Isolated Ground Duplex Receptacles: Duplex receptacles shall be 2-pole, 3-wire nylon grounding receptacles complying with current Federal Specification W-C-596F and U.L. Listed 498, isolated ground, NEMA 5-20R configuration. Receptacle shall have triangle symbol to denote the isolated ground configuration. Receptacles shall be orange if connected to normal power circuits. Receptacles shall be Hubbell #IG-2182 or equal by Cooper Wiring Premium Industrial Specification Grade and wall plate #80703-IG with a limited ten-year warranty.

G. Ground fault receptacle shall be extra heavy duty, UL listed Class A with 5 milli ampere sensitivity 20 ampere, 120 VAC, grounded, NEMA 5-20R. Receptacle shall have test and reset buttons integral with receptacle. Receptacles shall be Hubbell GF5362 or equal by Leviton or GE.

H. Weatherproof receptacles shall be ground fault type duplex receptacles with cast metal weatherproof covers that allow for complete coverage of receptacle during use.

I. Color:
1. Black receptacles unless part of plug mold.

2.02 SURFACE MOUNTED, MULTI-OUTLET RACEWAY (PLUG MOLD):

A. General: Steel, single channel surface raceway with pre-installed receptacles.

B. Minimum dimensions: Assembled base and cover shall be 1.29/32" wide by 7/8" high. The base shall be a minimum of 0.040" wall thickness and the cover shall be a minimum of 0.025" wall thickness. Length as required.

C. Material:
1. Steel with Ivory ScuffCoat for all exposed surfaces.

D. Two piece design with a base and a snap-on cover. Complete system shall include receptacles, and coverplates.

E. 20 Amp duplex receptacles 12" on center.

F. Raceway and all system components must be UL Listed and CSA certified.

G. MANUFACTURER:
1. Legrand, Plugmold, 2400 Series, or Engineer approved equal.

2.03 COVER PLATES:

A. Provide for standard switches and receptacles for areas unless noted otherwise. Cover plates to be brushed stainless steel 302.

B. Provide weatherproof rated gray switch coverplates for light switches located outdoors. Plate type based on a Hubbell HBL1795 or equal.

C. Provide weatherproof rated gray, cast metal receptacle coverplates for receptacles located outdoors. Receptacles covers shall be Hubbell WP8M, with appropriate cast back box, or approved equal.

2.04 LINE VOLTAGE THERMOSTATS:

A. Thermostats controlling heaters and cooling fans shall be heavy duty line voltage rated 16 amps at 120V for pilot duty sized for the contactor coil load, adjustable range 45° to 85° F with adjustable deadband range of 0-3 degrees.

B. Single pole, double throw suitable for operating as a two-stage cooling thermostat energizing the electric cooling load on rising temperatures.

C. The thermostat shall be Chromalox type WR80 or equal by Honeywell.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Mount wall switches 42 inches to bottom above finished floor.

B. Mount line voltage thermostats 60" to bottom above the finish floor in flush wall boxes.

C. Coordinate switch-mounting location with architectural detail.

D. Mount receptacles at height above work surface or as noted on the drawings. Match existing as much as possible.

E. Install cover plates on all wiring devices.

F. The outdoor units to be enclosed in cast aluminum boxes with cast aluminum, weatherproof cover plates.

G. Install in accordance with Drawings, submittals, and manufacturers recommendations.

H. Plug mold:
1. All raceway systems shall be mechanically continuous and connected to all electrical outlets, boxes, device mounting brackets and cabinets, also in accordance with manufacturer's installation instruction sheets.
2. All metal raceway shall be electrically continuous and bonded in accordance with the National Electrical Code for proper grounding.
3. Sharp edges shall be removed from field cut pieces to prevent damage to installed conductors.
4. Raceway shall be securely supported at intervals not exceeding 8 feet or in accordance with manufacturer's installation sheets.
5. All raceway systems shall be installed complete, including insulating bushings and inserts where required by manufacturer's installation sheets. Field cuts of raceway should be square such that no openings are present in the installed system. All unused raceway openings shall be closed.

END OF SECTION

SECTION 26 28 16
MOTOR AND CIRCUIT DISCONNECTS

PART 1 – GENERAL

1.01 DESCRIPTION:

A. Work of this section includes motor and general circuit disconnects including separately mounted disconnects and those mounted in motor control centers, panelboards, and switchboards.

1.02 RELATED SECTIONS:

A. Section 26 28 13 - Fuses.

B. Section 26 28 17 - Circuit Breakers.

1.03 SUBMITTALS:

A. Submit under provision of Section 26 05 00 and Division 1.

B. Provide shop drawings and product data for disconnects including outline and mounting dimensions, wiring schematic diagrams, short circuit current withstand ability ratings.

C. Provide operational and maintenance data including renewal parts for all disconnects.

PART 2 - PRODUCTS

2.01 DISCONNECT SWITCHES:

A. Provide disconnect switches with switch blades fully visible in "OFF" position, rated NEMA type HD, Underwriters Laboratory listed, with quick-make, quick-break operation handle, and mechanism forming an integral part of the box, not in the cover. All current carrying parts shall be plated to resist corrosion and have cool operation. The switches to have dual cover interlock to prevent unauthorized opening of door in the "ON" position or closing switch with door open. Provide padlocking provisions to allow at least three (3) padlocks to prevent switch operation in the "OFF" position. Provide safety switches, fused, non-fused to horsepower rated, as required.

B. Switches shall have NEMA 1 or NEMA 3R rainproof enclosure as a minimum or as shown on drawings or described below. The disconnect switch type enclosures shall be made of the following steel: NEMA 1 - Code gauge (UL 90) sheet steel; NEMA 3R - Code gauge (UL 98) galvanized steel. All enclosures to be given a rust-inhibitive phosphate treatment and then a coat of baked-on-gray enamel.

C. Provide fusible disconnect switches with clips for fuses which have UL listed short circuit rating of 200,000 rms symmetrical amperes when Class R or Class J fuses are used.

D. In acid and corrosive areas the disconnect switch enclosures and operators shall be of fiberglass-reinforced polyester with stainless steel hardware and be gasketed to protect the exterior mechanisms. Switches shall be NEMA 4X rated.

E. In outdoor or wet locations areas the disconnect switch enclosures and operators shall be of non-metallic, corrosion resistant with stainless steel hardware and be gasketed to protect the exterior mechanisms. Switches shall be NEMA 4X rated.

F. Disconnect switches shall be provided with mechanical type lugs suitable for the conductors used.

G. Acceptable Manufacturers:
   1. Square D, Eaton, GE or Siemens.
   2. Or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install motor and circuit disconnects in accordance with manufacturers recommendations and applicable codes.

B. Provide fuses of required rating in each fused switch.

C. Inspect all disconnect devices for damage. Verify operation of the disconnect prior to energizing or adding load.

END OF SECTION

SECTION 26 28 17
CIRCUIT BREAKERS

PART 1 – GENERAL

1.01 DESCRIPTION:

A. Work of this Section includes circuit breakers and their related enclosures.

1.02 RELATED SECTIONS:

A. Section 26 24 16 - Panelboards.

B. Section 26 19 13 - Motor Controllers.

1.03 SUBMITTALS:

A. Submit under provision of Division 1.

B. Product data including applicable shop drawings.

C. Coordination and characteristic curves for circuit breakers.

D. Test reports.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Molded Case Circuit Breakers:
1. 120, 208, 277, 480 volt.
2. 50, 100, 250, 400 ampere frame.
3. 15 through 400 continuous ampere rating.
4. Thermal magnetic trip unit.
5. 1, 2, and 3 pole.
6. Interrupting current rating as noted on the schedules.
7. Ground fault interrupters with 4-6 mA sensitivity.
8. Trip free mechanism.
9. Quick make, quick break mechanism.
10. Plug-in line bus connected.

B. Motor Circuit Protectors:
1. 480 volt.
2. 50, 100, 225 ampere frame.
3. continuous ampere rating as required for load size.
4. Instantaneous adjustable trip range with lockable positions.
5. 2, 3 pole.
6. 35,000A interrupting rating.

C. Options Available for Circuit Breakers:
1. Line and load lugs suitable for use with copper conductors with standard copper pressure, set screw fastening, aluminum alloy, terminals.
2. Mechanical interlocking of walking beam or sliding bar type.
3. Enclosure of NEMA Type 1.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Circuit breakers to be mounted in enclosures, panels, load centers or motor control centers.

B. Enclosure for circuit breaker shall be properly grounded.

C. Attach handles so as to not interfere with cover plate or door.

D. Properly mount circuit breaker so that acceptable electrical connection is made to bus work.

E. Terminations to breaker terminals shall be to industry standards.

END OF SECTION

SECTION 26 29 13
MOTOR CONTROLLERS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. The work of this section includes separately mounted motor starters, and starters integrally mounted within motor control centers.

1.02 SUBMITTALS:

A. Submit under provision of per requirements of Division 1.

B. Provide shop drawings for motor starters separately mounted including outline and wiring diagrams.

C. Provide Product Data including:
1. Outline mounting dimensions and wiring diagrams.
2. Component layout.
3. Motor starter contactor.
4. NEMA starter size.
5. Control transformer.
6. Overload relay.
7. Overcurrent disconnects device data.
8. Push buttons, selector switches and pilot lights.

D. Provide operation and maintenance data including renewal parts for all starters. Include listing of each application showing motor nameplate details, starter size and type and overload heater sizing.

PART 2 - PRODUCTS

2.01 MANUAL MOTOR STARTERS:

A. Manual starters shall be used only on single-phase fractional (1/2 or less) horsepower motors unless specifically noted otherwise on the drawings.

B. Toggle switch operated type equipped with (melting alloy) thermal overload relay, which shall be one piece and allow use of interchangeable heater elements.

C. Reset device to be trip free operation, and render the starter inoperative if the interchangeable heater is removed.

D. The "ON" position located up toward the top of the enclosure.

E. Provide NEMA 1 enclosure for surface mounting with standard stainless steel flushplate.

F. Enclosure to be equipped with handle guard and provision for padlocking in OFF position.

G. Equipped with pilot light indicating when starter is in "ON" position.

H. Starter shall have an operating contact pole for each ungrounded conductor.

I. Acceptable Manufacturers: Eaton, Square D, Siemens or Allen-Bradley.

2.02 COMBINATION MOTOR STARTERS:

A. Starters' contactor shall be NEMA type as shown on the drawings. IEC starter contactors are acceptable and shall be rated for the motor full load amp range as required.

B. Provide with motor circuit protector with ratings as shown on the Drawing. Provide padlocking in "OFF" position. Operating voltage shall be 480 volt, 3 phase unless noted otherwise.

C. Provide NEMA 1 General Purpose Enclosure or as noted on the drawings.

D. Starter shall have double break silver alloy contacts through NEMA size 3 which shall be replaceable without removing any power wiring or the starter.

E. Coils to be molded construction through NEMA size 5 (and form wound taped, varnished and baked on NEMA size 6 and larger) replaceable from the front without removing the starter.

F. Provide a solid-state adjustable overload relays which shall be removable from the front of the starter. Overload relay shall be equipped with a manual reset, test and stop buttons, and fault trip reason on the face of the relay. Relay shall be manually reset from front of starter enclosure and shall be "Trip Free" not allowing the overload relay control contacts to reclose or render harm to the motor load or starter. Relay shall provide current unbalance and ground fault protection for the motor. Relay shall have selectable starting class ratings and restart delay.

G. Shall have suitable space for the addition of auxiliary contacts of any arrangement of normally open or normally closed and shall accept 4 contacts. These contacts shall be in addition to the normal "seal in" contact. Auxiliary contacts, which shall be provided, are as follows 2-NO and 2-N.C.

H. Provide a three position Hand-Off-Auto selector switch green transformer type run pilot light on the front of the enclosure.

I. Provide a control circuit transformer of ample capacity (minimum 50VA) to operate the control circuit at 120 volt. Control transformer shall include two (2) primary fuses and one (1) secondary fuse.

J. Control circuits and relays shall be provided as shown on Drawings with contacts rated not less than 120 volts, 10 amperes.

K. Mechanical interlocks shall be provided to prevent access to inside of starter cabinet by unauthorized personnel when switch is in "ON" position.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install in accordance with manufacturer recommendations and applicable codes.

B. Configure overload relays to provide proper motor overload protection in accordance with NEC considering motor service factor, temperature rise, ambient temperatures and other applicable factors. Configure restart time delay to "stagger" equipment restart on return to power after power failure.

C. Connect controls in accordance with wiring diagrams.

3.02 VISUAL AND MECHANICAL INSPECTION:

A. Document equipment nameplate data on test report. Verify that equipment nameplate ratings are in accordance with drawings and specifications. This will include: contactor, fuses, overloads, circuit breakers, overload relay heaters, and the control power transformer.

B. Inspect the physical and mechanical condition of the equipment. Do not conduct any electrical tests until operation

3.03 ELECTRICAL TESTS:

A. NOTE: When performing dielectric tests, you must disconnect all Instrument and Control Transformers, Arresters, TVSS units, and other sensitive electronic equipment that may cause erroneous results or cause damage to equipment that is not rated in accordance with the equipment standards.

B. Electrical tests shall not be performed on single-phase manual motor starters.

C. Perform operational tests by initiating control devices.

D. Verify proper phase rotation of motor load and swap conductors on control contactor as required.

E. Test the motor overload relay elements by injecting primary current through the overload circuit, and monitoring the trip time of the overload element.

END OF SECTION